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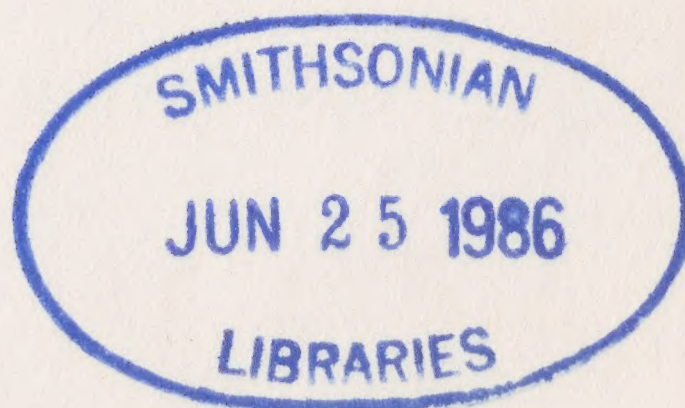
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Biology and taxonomy of the Rhopalomyia
Gall Midges (Diptera: Cecidomyiidae) of Artemisia tridentata
Nuttall (Compositae) in Idaho

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ABSTRACT

Twenty-eight species of gall midges have been found associated with big sagebrush, Artemisia tridentata Nuttall in Idaho. These species belong to Rhopalomyia, subgenus Diarthronomyia; 22 are new to science, and 4 are not assigned names. The new species described here are: anthoides, brevibulla, calvipomum, conica, cramboides, culmata, florella, gossypina, hirtibulla, hirticaulis, hirtipomum, lignea, lignitubus, mammilla, medusa, medusirrasa, nucula, obovata, rugosa, tubulus, tumidibulla, and tumidicaulis. The 2 previously described species are R. ampullaria Felt and R. artemisiae (Felt). The latter is given the new replacement name R. pomum.

Each species is responsible for a particular kind of gall, and all have similar life histories, differing mainly in their phenological relationship with the plant. The galls are specifically localized on all developing aerial parts of the host. The eggs of the several species observed are deposited separately or in masses on the surface of the plant near or on the part to be infected. Larval and pupal development occur within the galls, with the larva overwintering. Adults emerge shortly after the pupae break through the gall surface. Each day males emerge shortly before the females to begin to fly concurrently with female emergence at sunrise. Males, singly or in swarms, seek out the females and mate repeatedly. Females mate once and begin oviposition a few hours later. Most, if not all, activity of these short-lived adults is over by midday. Twenty-two species are univoltine, 2 bivoltine.

The impact of galls on the plant ranges from mortality to no apparent effect. Some gall midge species are limited in their potential destructiveness by platygasterid and chalcidoid parasitoids. Oxyna palpalis (Coquillett), a tephritid fly, and Apion sordidum Smith, a curculionid beetle, areinquilines in several of the larger galls.

INTRODUCTION

Sagebrush, Artemisia spp., is a dominant plant group in extensive areas of western North America. It holds an important and sometimes conflicting role in range and wildlife management programs: there are needs both for its protection as browse and cover shrubs and for its control in order to increase grassland grazing areas. In Idaho, sagebrush vegetation or several types derived from it occupy an estimated 17 million acres (Tisdale et al. 1969). One of the species, Artemisia tridentata Nuttall, host to the gall midges treated in this study, occurs on most of this acreage.

Insects galls are common on Artemisia species and sometimes occur in such large numbers that they are probably an important factor in the ecology of sagebrush. Yet, until this study, these galls and their gallmakers (Figs. 1 and 2) were poorly known. Eleven species of gall midges (Cecidomyiidae) reared from galls on Artemisia from western North America were named and cursorily described, but subsequent recognition of most of these midges was impossible because the stage or sex bearing the characters needed for discrimination were unknown. Although the galls made by some of these midges were described in recognizable detail, in most cases species identification based on the gall was difficult because the precise host species were unreported and more than one kind of gall was purportedly made by the same species of gall midge.

This study was undertaken to ascertain the identity of the gall makers, to study their life history and the development of the galls, and to investigate the effect of the galls on the host plants. The scope of the project was

limited to big sagebrush, Artemisia tridentata and its subspecies, in the general area of southern Idaho. Using this widely distributed host in such a large area we hoped that our results, even though incomplete for many species, would allow us to predict with confidence the biology and impact of gall midges on other Artemisia species in Idaho and elsewhere.

ACKNOWLEDGEMENTS

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METHODS

Field Studies

Gall collections, rearings, and detailed study of gall midges were made throughout the sagebrush region in Idaho. More than 140 locations were involved. The collections were begun in 1955, the detailed study commenced in April 1968 and continued through July 1970, with short collecting periods subsequent. A few collections were also made on A. tridentata in Montana, Nevada, Utah and Washington at sites adjacent to Idaho. Up to 39 visits to a specific site were made during the detailed study period, depending on the presence and abundance of galls. These specific study sites are listed in Table 1.

Some galls were left undisturbed on plants at different sites for periodic observation of gall development. Other galls were collected for rearing and dissection. The gall dissections were made at two to four week intervals, except from December through February, for each of the more common midge species to follow larval and pupal development. Weather conditions permitted only one or two collections during the three winter months.

Samples of galls of each midge species were collected from each site for a reference collection. At first, these were preserved in either 70% ethanol or FAA (Formalin, 1 part; glacial acetic acid, 1 part; 50% ethanol, 18 parts). Later we preserved the galls on insect pins because dried galls do not shrink or discolor. Foliage was collected and examined in the laboratory for small galls or early developmental stages of galls. To rear adults in the laboratory, supplemental field collections of galls were made when pupae were fully developed. The size of all these collections depended on the abundance of galls.

Adult behavior studies were conducted on 3 midge species. Rhopalomyia pomum was studied at Sites 1 through 4, R. ampullaria at Site 13, and R. gossypina at Site 24. Ten plants with large numbers of galls were selected and tagged for identification at each site. During the hour before dawn five 4" x 4" dark green boards with mineral oil on both surfaces were hung on separate branches of each plant. Counts were taken of trapped adults at hourly intervals from sunrise to midday, when adults were no longer active. Temperature, humidity, and wind velocity were recorded hourly. Emergence, mating, and oviposition were observed between hourly recordings.

At each of the R. pomum sites five of the 10 tagged plants were examined for distribution of the galls. The plants were divided into north-south and east-west quadrants and a center section. All branches were removed from each of the five sections and gall counts made. The effect of gall formation on the buds of these plants also was noted.

Caging studies were conducted on R. pomum and R. gossypina to determine whether these midge species consistently cause the same gall type on different plants as the one from which they emerge. The studies were done in a test plot at the USDA Entomology Research Station at Twin Falls. In the fall of 1968 and spring of 1969, numerous young, gall free plants of A. t. tridentata and A. t. vaseyana were transplanted into the test plot. The test plot was well isolated from other sagebrush plants. As the pupae of each midge species in field collected galls neared maturity, the galls were taken from rearing containers and placed with several individually screen-caged plants in the test plot. After about a week the galls and the cages were removed. Each plant was examined throughout the season and the following spring to determine whether gall development occurred and whether it was typical of that midge species.

Laboratory Studies

Adult gall midges were reared for identification and for verification of their association with the gall and host plant. Best results in obtaining adults came from galls containing mature pupae. Galls were separated by form, plant part affected, collection site, and collection date and reared at room temperature individually or in mass in vials and plastic bags. Moisture was a problem in both types of containers and mold was common. Daily records were maintained of all emerged specimens, including parasitoids and associated insects. Specimens were preserved in 70% ethanol or pinned.

An intensive rearing study was conducted with three midge species (R. pomum, R. ampullaria, R. gossypina). Fifty galls of R. pomum from each of Sites 1, 3 and 4 and 43 galls from Site 2 were collected prior to adult emergence. Each gall was measured and placed in a 40 dram plastic vial or small jar. Daily emergence records were kept. A few females (adults and pupae that wiggled from the galls) were preserved in Bouin's solution for subsequent egg counts. All other specimens were preserved in 70% ethanol. The same general procedure was followed for the other two midge species except for R. ampullaria 90 leaves bearing one to 20 galls were placed in individual rearing chambers. Fifty galls of R. gossypina were preserved in 70% ethanol after 16 days in rearing, and the larval capsules were subsequently counted and examined.

Egg masses of the midge species were field collected whenever possible and preserved in 70% ethanol. These and egg masses dissected from adults and pupae were counted and measured under a dissecting microscope.

Over 1,000 specimens were studied taxonomically, and most were collected expressly for this study. For detailed examination it was usually necessary to mount specimens on slides for viewing under a phase contrast microscope. Permanent mounts were made with Canada balsam. Anatomical drawings were done either from these slides or from cleared specimens placed in a drop of glycerin on a depression slide.

Most of the study material including the holotypes of the new species is deposited in the U.S. National Museum of Natural History (USNM). A synoptic collection is at the University of Idaho, and paratypes of most species as available have been deposited in the California Academy of Sciences, San Francisco. Most of the extant types of the previously described Nearctic species of Rhopalomyia are in the U.S. National Museum of Natural History, either in the regular collection or in the Felt Collection, which is on loan

Table 1. Locations, elevations, and host plants of study sites mentioned in the text.

Site #	Location	Elevation	Sagebrush Taxa
1	Twin Falls Co. 5 miles east of Twin Falls	3746 feet	<u>A. t. tridentata</u> <u>A. t. wyomingensis</u>
2	11 miles south of Hansen	4300 feet	<u>A. t. tridentata</u>
3	23 miles southwest of Twin Falls	4950 feet	<u>A. t. tridentata</u>
4	17 miles south of Hansen	4725 feet	<u>A. t. vaseyana</u>
5	21 miles south of Hansen	5240 feet	<u>A. t. vaseyana</u>
6	22 miles south of Hansen	5700 feet	<u>A. t. vaseyana</u>
7	Magic Mountain Ski Areas	6400 feet	<u>A. t. vaseyana</u>
8	Blaine Co. Galena Summit	8600 feet	<u>A. t. vaseyana</u>
9	Butte Co. 0.5 miles west of Arco	5300 feet	<u>A. t. tridentata</u>
10	Camas Co. 11 miles north of Fairfield	6500 feet	<u>A. t. v. f. spiciformis</u>
11	12 miles south of Fairfield	5450 feet	<u>A. t. vaseyana</u>
12	Canyon Co. 15 miles south of Nampa	2500 feet	<u>A. t. wyomingensis</u>
13	Cassia Co. 4 miles west of Almo	6200 feet	<u>A. t. tridentata</u> <u>A. t. vaseyana</u> <u>A. t. wyomingensis</u>
14	Custer Co. 8 miles northwest of Mackay	6200 feet	<u>A. t. vaseyana</u>
15	Elmore Co. 3 miles north of Mt. Home	3325 feet	<u>A. t. wyomingensis</u>
16	7 miles south of Mt. Home	3000 feet	<u>A. t. wyomingensis</u>
17	Franklin Co. 28 miles northeast Preston	6850 feet	<u>A. t. v. f. spiciformis</u>
18	3 miles west of Dayton	4800 feet	<u>A. t. vaseyana</u>
19	Gooding Co. 11 miles south of Bliss		<u>A. t. tridentata</u>
20	3 miles southeast of Bliss	3140 feet	<u>A. t. wyomingensis</u>
21	9 miles west of Bliss	3000 feet	<u>A. t. tridentata</u> <u>A. t. wyomingensis</u>
22	3 miles south of Hagerman	2964 feet	<u>A. t. wyomingensis</u>
23	Lincoln Co. 11.5 miles west of Kinama	4275 feet	<u>A. t. tridentata</u>
24	Minidoka Co. 2 miles east of Acequia	4200 feet	<u>A. t. tridentata</u>
25	Oneida Co. 9.5 miles west of Malad	5200 feet	<u>A. t. vaseyana</u>
26	Teton Co. 4.5 miles west of Tetonia	6025 feet	<u>A. tripartita</u>
27	Washington Co. 8 miles north of Weiser	2580 feet	<u>A. t. v. f. xericensis</u>
28	Beaverhead Co., Montana 17 miles east of Bannock Pass Summit		<u>A. t. tridentata</u>
29	Adams Co., Washington 1.2 miles north of Washtucna		<u>A. t. tridentata</u>

to the Systematic Entomology Laboratory from the New York State Museum, Albany. The type of Rhopalomyia tridentatae Rübsaamen was obtained from the Staatliches Museum für Naturkunde, Stuttgart, West Germany.

Systematic Presentation

The arrangement of the midge species is in order by location on the plant as indicated in Table 2. Under each species we present our information concerning its taxonomy and anatomy, its biology, the gall, associated insects, and its host plants and geographical distribution. Letters are assigned to distinguish among unnamed species of the parasitoid genus Platygaster. The subspecies Artemisia tridentata wyomingensis and A. t. vaseyana "form xericensis" were not recognized during the first season of this study; thus host identification for sites not visited after 1968 is only at species level. In general, R. G. Jones and W. F. Barr are responsible for the field data in this study, R. J. Gagné for the gall midge systematics. Gagné is the author of the new species.

The specific names chosen for the new taxa describe some aspect of the galls. Following is an alphabetical list of each valid specific name and its meaning (all except ampullaria and pomum are new): ampullaria (adjective), ampulelike; anthoides (adj.), flowerlike; brevibulla (noun), short bump; calvipomum (n.), smooth apple; conica (adj.), cone-shaped; cramboides (adj.), cabbagelike; culmata (adj.), stalked; florella (n.), little flower; gossypina (adj.), cottony; hirtibulla (n.), fuzzy bump; hirticaulis (n.), fuzzy stem; hirtipomum (n.), fuzzy apple; lignea (adj.), woody; lignitubus (n.), woody tube; mammilla (n.), small teat; medusa (n.), Medusa; medusirrasa (n.), fuzzy Medusa; nucula (n.), little nut; obovata (adj.), obovate; pomum (n.), apple; rugosa (adj.), rugosa; tubulus (n.), little tube; tumidibulla (n.), swollen bump; tumidicaulis (n.), swollen stem.

HOST PLANTS

Several taxonomic units are included under the species A. tridentata. Beetle (1960) recognized two subspecies and two forms, each occurring in Idaho. These are basin big sagebrush, A. t. tridentata; mountain big sagebrush, A. t. vaseyana; Parish sagebrush, A. t. tridentata form parishii and subalpine sagebrush, A. t. vaseyana form spiciformis. Further study (Beetle and Young 1965) resulted in the recognition of the third subspecies of this complex: Wyoming big sagebrush, A. t. wyomingensis. Winward and Tisdale (1977) studied the taxonomy and ecology of this complex in Idaho. They found important taxonomic characters in the number of flowers per head and heads per stalk, vegetative and flower stem length, and leaf length-width ratios. They established the distribution of all subspecies in the state, confirmed the validity of A. t. vaseyana form spiciformis and recognized a previously undescribed taxon which they tentatively referred to as A. t. vaseyana "form xericensis." Winward rejected the A. t. tridentata form parishii because the distinguishing character of a drooping inflorescence is present in both A. t. tridentata and A. t. wyomingensis and cannot be related ecologically or geographically.

Sagebrush vegetation extends over much of southern Idaho (Tisdale et al. 1969). Winward (1970), in studying the distribution of A. tridentata in Idaho, found A. t. tridentata to have an elevation range of 2500 to 7000 feet and a preference for the deep, well-drained soils of valley bottoms and lower foothill regions. Artemisia t. vaseyana is found at elevations from 4500 to 8000 feet on relatively deep soils throughout the upper foothill and mountain areas. The form spiciformis nearly always occurs at elevations about 7000

feet and is restricted to localized mesic sites. The "form xericensis" (= A. tridentata "X" as characterized by Winward and Tisdale, 1977) is known in the west-central portion of the state where it occurs in relatively dry sites in an elevation range of 2500 to 4500 feet. Artemisia t. wyomingensis occurs at relatively shallow soils of the hotter and drier portions of the state at elevations ranging from 2500 to 6500 feet.

Dietert (1938) found the most striking characteristics of A. tridentata to be its evergreen foliage and absence of winter buds. Due to these features the stem tip has much the same appearance throughout the year. Two types of branches, flowering and vegetative, are produced each year. In early growth there is no apparent difference between the two, either externally or internally. However, on about the first of June when the new branches have reach a length of 5 - 15 cm or more, external differences gradually become apparent. From this time on the flowering branches elongate more rapidly. These die with the ripening of the seed in the fall, but usually persist on the plant until the following summer or even for several years.

The flowering branches or sprays are panicles with small, sessile heads. The bracts or leaves that subtend the branches of the flowering spray vary from typical tridentate leaves near the base of the spray to much smaller entire linear ones toward the apex. These bracts, as a rule, are shed before the flowers reach maturity.

Two leaf series occur on the vegetative branches. Winward and Tisdale (1977) refer to these as ephemeral and persistent leaves. The irregularly lobed ephemeral leaves are produced early in the year and are shed as the season advances. Persistent leaves are typically three-lobed and remain on the plant through the winter. All leaves, bracts, and current year's growth of branches are densely clothed with trichomes, giving them a silvery gray appearance.

Winward and Tisdale (1977) also reported phenological differences among the three subspecies and two forms of A. tridentata. Artemisia t. tridentata and A. t. wyomingensis begin growth approximately 2 weeks earlier and have ripened seeds at least two weeks later than A. t. vaseyana.

THE SAGEBRUSH GALL MIDGES

Biology

Except for some spatial and phenologic variations, the life histories of the gall midges appear to be quite similar. The only other species of the subgenus Diarthronomyia whose biology has been studied in any detail is R. chrysanthemi Ahlberg, as summarized in Barnes (1948). Its biology is similar to that of the species treated here except that instead of the one or two generations per year for these sagebrush associated species, R. chrysanthemi may have up to five.

Egg

Eggs of the several species observed are similar in appearance in gross aspect and differ only in size. The eggs are deposited singly or in masses on the surface of the plant near or on the special part where gall development occurs. The duration of this stage has not been determined, but in R. pomum at least, it is less than 16 days. Barnes (1948) reported that this stage lasts from three to 22 days for R. chrysanthemi, depending on temperature.

Larva

All species overwinter as larvae within the gall, but the age of the overwintering larva varies among species. The overwintering larval age appears related to the phenology of the host plant. Species such as R. pomum and R. hirtipomum overwinter as young larvae in galls which are first evident in the fall. At the other extreme, R. obovata overwinters as mature larvae in galls which have completed development and are beginning to deteriorate.

Eclosion and other activities of immature larvae were not observed, but Barnes (1948) found that larvae of R. chrysanthemi move about on the plant surface and bore into the tissue within 24 hours after eclosion. Spence (1969) found that newly hatched larvae of R. hirtipes (Osten Sacken) also are quite mobile. This may explain why galls of certain sagebrush associated species, e.g. R. brevibulla, are produced on plant organs other than those on which their eggs are deposited. The penetration of the plant tissue by larvae is evident by the brown spots or scars on the surface of the galls of R. pomum and R. calvipomum.

The time lapse between oviposition and gall development varies with the midge species. For example, galls of R. pomum were not evident until four months after oviposition while those of R. obovata could be found about two months after oviposition. Barnes (1948) reported a time lapse of 16 to 102 days between larval penetration into the plant tissue and the appearance of a visible gall for R. chrysanthemi, but that variation was seasonal and could be altered under greenhouse conditions. A shortened time lapse was obtained in this study with greenhouse incubation of the galls of R. gossypina. These galls were visible about January 20 under greenhouse conditions while those developing under field conditions were not visible until early June.

Pupa

Pupation occurs within the larval chamber of the gall and appears to be brief; for R. pomum this stage lasts about 15 days. The duration probably varies according to species to within a week or so of this depending on weather conditions. Barnes (1948) found it to vary from six to seven days to several weeks for R. chrysanthemi depending on the season. With maturity the abdomen of the female pupa becomes red.

The pupa escapes the gall either by cutting its way out or by breaking the gall. The antennal and facial horns of the pupa are used in this activity. There may be a correlation between the prominence of the antennal horns and the most solidly walled galls.

When the pupa reaches the outer gall surface, the adults emerges. The pupal exuviae are left attached to the gall. The presence of exuviae is useful in ascertaining the occurrence and extent of emergence.

Adult

The seasonal occurrence of adults is related directly to the phenology of the host plant. Midges emerge at or about the time of the development of the plant organ or part on which the galls occur. Midge emergence and both midge and gall development varied between sites: later development in the spring coincided with elevation and geographical areas in Idaho that consistently had later growing seasons. Observations were in general agreement with Winward and Tisdale (1977) that A. t. vaseyana begins growth two weeks later and ripens seed at least two weeks earlier than A. t. wyomingensis and A. t. tridentata. This generally explains the later emergence of R. pomum at Site 4, where only A. t. vaseyana was present. At Site 13, however, three

subspecies of A. tridentata occurred intermixed within the same area. The phenology of all three was similar, and R. ampullaria which occurred on each, emerged concurrently from each subspecies.

Midges emerge through a dorsal split in the thoracic exoskeleton of the pupa. Emergence is influenced by temperature and relative humidity, with different thresholds of these factors apparent for males and females of a species. Light also may be a factor. Males consistently emerge earlier in the morning than females when the temperature is lower, relative humidity higher, and apparently before daylight in most instances. Females emerge at sunrise or shortly thereafter. Emergence and other adult activities take place during a daily period of high relative humidity. Humidity may be of special importance in a desert community, where desiccation would be fatal to the adults.

Male flight occurs when light and temperature are favorable. The minimum temperature at which flight was observed was 48°F. The primary function of male flight is to seek out females and mate. Observations and trapping indicate that males seek females both individually and in male swarms, at least for R. pomum, R. ampullaria and R. gossypina.

The sex ratio for R. pomum favors the female (see under that species). Assuming that males are as efficient in seeking out females as they appear to be, the high female to male ratio provides the required high reproductive potential to offset possible catastrophies. Observations showed females of R. pomum and R. gossypina mate only once, while males of these species mate several times.

Host Plant and Geographical Distribution

Galls were found on all subspecies and forms of A. tridentata throughout the study area in Idaho. However, it is doubtful that all midge species associated with Artemisia tridentata in Idaho have been found. The distribution of these midge species outside of Idaho is not known, although limited observations in Montana and Washington showed only one gall different from those found in the state. Fronk et al. (1964) in their work in Wyoming on dipterous galls of the A. tridentata complex, recorded a midge species, Asphondylia sp. on A. tridentata. This genus was not encountered in the present study.

Gall

The structural variety of midge galls on Artemisia is remarkable. Galls are found on all non-woody aerial growth: the two leaf series, flower and vegetative buds, leaf and stem nodes, and green stems (Table 2). The majority of galls occur on the plant parts that remain through the winter. The exceptions to this are the galls of the ephemeral leaf series which remain on the plant for a relatively short period. Two gall midges form galls on this leaf series. One, R. ampullaria, has two generations per year. The second generation forms the same type of gall as on the ephemeral leaves but on the flower buds instead, in which the larvae overwinter. Rhopalomyia culmata, which causes the second kind of ephemeral leaf gall, probably has another generation, but we did not find it.

The seasonal occurrence of these two galls appears directly correlated to that of normal plant growth. Development of the galls generally begins with the start of normal growth of that part on which they occur, and ceases when normal growth stops. This is most apparent in both leaf and flower bud galls of R. ampullaria. The development of the galls on the persistent leaf series opens some questions, however, Dietert (1938) stated that the persistent

leaves overwinter as mature leaves on the plant and are dropped soon after growth is resumed in the spring. If this is true, then these galls develop mostly on a mature organ. Further study may show that the persistent leaf series is similar to the embryonic leaves which Dietert believes have been arrested in various stages of development in the fall and resume their growth in the spring.

Those midge species which have the greatest impact on their host plant appear to be those which cause bud galls. These prevent further plant growth by killing the bud. However, most infested plants are not severely damaged because of generally low numbers of this type of gall and because the impact of these gall causing midges is lessened by the large number of parasitoids associated with them.

The galls are prosoplastic, which means that their form is constant in size and structure and is the result of a restructuring of the plant cells. As to their cause, we cannot improve on Kinsey's (1936) noncommittal definition that galls are the "expression of the physiologic nature of the stimulus provided by the insect."

Systematics

All gall midges encountered in this study belong to the subgenus Diarthronomyia of the genus Rhopalomyia (Gagné 1975), one of the larger genera of the supertribe Oligotrophidi. Rhopalomyia is characterized by the following combination of characters: the presence of one or two palpal segments, blunt-tipped claspettes of the male genitalia, ovoid female cercus, longer legs and wings in males than in females, and the lack of a spatula and the general reduction in number and size of the papillae in the larvae. In addition, all included species cause complex galls that are found chiefly on Compositae.

Species of the subgenus Diarthronomyia are distinct from other Rhopalomyia on Compositae in the lack of lateral setae on the adult abdominal terga. Also, unlike other Rhopalomyia, many species of Diarthronomyia have teeth on the tarsal claws. The subgenus is at least Holarctic and its species occur exclusively on species of Artemisia and Chrysanthemum.

The reduction in the number of useful diagnostic characters in Rhopalomyia as compared with some other groups of cecidomyiids is striking. The palpus and antenna have a reduced number of parts and can vary in shape within a species. Setation is generally reduced and even the trichoid sensilla, the two sensory setae present at the base of the abdominal sterna of almost all gall midges, show reduction in these Artemisia associated midges from two to one or none. The larva has lost the sternal spatula and the few terminal papillae remaining are barely perceptible. Nevertheless it has been possible to recognize apparent relationships among certain species, and these are discussed in the species diagnoses.

In the past, Diarthronomyia midges were formally segregated according to the expression of a few characters such as the number of palpal segments and the presence or absence of teeth on the tarsal claws (Gagné 1975). The present study shows that although such characters are helpful for separating species, they are by themselves of no use in determining evolutionary relationships. For example, R. hirticaulis has simple tarsal claws and R. tumidicaulis toothed claws, but apparent similarities in the shape of the male genitalia and pupal heads and the location and structure of the galls indicate that the two species are closely related.

In this study, we recognize 26 species of Rhopalomyia on A. tridentata, each of which was reared from a distinct type of gall. Males and pupae from most of these can be distinguished anatomically from all others, but there are two pairs of species whose members appear identical. These are R. pomum, R.

Table 2. Summary of the gall forms on different plant organs by midge species with seasonal occurrence, host and geographical prominence in Idaho, 1968 through 1970.

Midge Species	Generalized Seasonal Occurrence of Gall	Occurrence at or on number of		
		A. tridentata sites in Idaho	A. tridentata Taxa	Other Artemisia spp.
Galls of the Persistence Leaf Series				
R. pomum	October to June	97	3	4
R. calvipomum	October to June	20	4	1
R. hirtipomum	October to June	12	4	0
R. tubulus	October to June	5	2	0
R. rugula	October to May	1	1	0
R. hirtibulla	October to April	8	3	0
R. brevibulla	October to April	1	1	0
R. tumidibulla	October to May	2	1	0
Galls of the Ephemeral Leaf Series				
R. ampullaria	May to August	10	3	1
R. culmata	May to June	3	3	0
Galls of the Branch Tips (Buds)				
R. gossypina	May to October	4	1	1
R. lignea	August to May	4	2	0
R. sp. nr. lignea	August to May	5	1	2
R. lignitubus	March to June	8	4	0
R. cramboides	June to May	8	2	0
R. anthoides	June to April	23	4	0
R. florella	June to April	3	2	0
R. conica	March to June	23	4	3
R. mamilla	March to October	8	3	0
R. obovata	June to April	53	4	2
Galls of the Leaf and Stem Nodes				
R. nucula	June to April	35	4	1
R. medusa	September to May	75	5	4
R. medusirrasa	October to May	14	1	0
Galls of the Stem				
R. hirticaulis	May to August	2	1	0
R. tumidicaulis	May to September	1	1	0
R. ampullaria	May to April	1	3	0
Galls of the Flower Buds				
R. ampullaria	September to September	1	3	0

hirtipomum and R. medusa, R. medusirrasa. The galls formed by members of each pair are similar in location on the plant and gross structure except that galls of one member of the pair are fuzzy; of the other, smooth. Cage experiments with R. pomum support the conclusion that succeeding generations of the midges make galls that are true to parental form. Consequently, the members of each pair can be recognized by characteristics of their galls.

Rhopalomyia, being a dynamic group of insects, should reflect the gradations that are part of the process of speciation. Not only might there be long established species that have become anatomically distinct from their sister species, there might also be some species pairs that have more recently diverged and whose existence is less demonstrable anatomically. As indicated above, we have some cases of similar specimens being reared from different types of galls that retain their identity through successive generations. We assume that the galls are the expression of the chemical reactions between the plant and the salivary secretions of the larvae. Therefore, if the galls are distinct, the genetic makeup of the gall midges is distinct also. Most of the gall midges from the several gall types are different, at least in male and pupal characters. Females are less distinct and larvae even less so. Therefore, our working species definition for these in the subgenus Diarthronomyia is as follows: a species is a population that is usually distinguishable in the totality of its anatomical characters and that is responsible for one particular type of gall on its host plant species.

A problem barely touched upon here concerns the fact that similar galls from different Artemisia species do not yield the same species of Rhopalomyia. For example, galls similar to those of R. pomum, but on A. arbuscula or A. nova, yielded adults that were similar to R. calvipomum, and galls like those of R. tumidibulla on A. arbuscula were made by a very different species of gall midge not treated further here. It is possible that the salivary secretions of the larvae find a different expression among the different species of Artemisia, but it seems more likely that Rhopalomyia spp. are closely host specific.

Because we studied material only from southern Idaho and immediate environs, we do not know if our species characterizations are valid throughout the range of Artemisia tridentata. As a follow-up of this research it would seem worthwhile to study a few of the commoner galls throughout the range of A. tridentata and their presence on other Artemisia of the Section Tridentatae.

On the other hand it would seem less fruitful and justifiable to pursue further studies such as the present one on other species of Artemisia. As a result of this study we know that Artemisia gallmakers belong to the subgenus Diarthronomyia, we can generally predict their biology, and we can estimate their impact on the host by the location and abundance of the galls. Additional studies could be expected to provide little new, basic information. Also, these gall midges are difficult to distinguish because of the reduction and dearth of characters: considering the number of Diarthronomyia present in the world (Gagné 1975) one could conceivably find anatomically similar species that are not at all closely related. Because of these difficulties and unless significant new information is forthcoming, we believe that there is little to gain by giving names in the future to the undoubtedly numerous new species of Diarthronomyia associated with Artemisia spp. It would be adequate to designate such species found in the course of faunal surveys or other studies simply as "Rhopalomyia (Diarthronomyia) sp." along with a characterization of its gall.

Taxonomic Characters

Following is a list of characters used in the species descriptions. Only a few are good key characters; most have great ranges of variation and are

useful only in combination or under certain circumstances.

Adult Characters:

- Separation of eyes on vertex: the eyes are usually connate but may be separated by a distance of as many as 4 facet diameters.
- Number of antennal flagellomeres and length of necks of flagellomeres III, V, and VII relative to their respective nodes.
- Number of segments and shape of the palpus.
- Shape of labellum: ellipsoid to semicircular.
- Number of setae on frontoclypeus and labellum, and number and sites of setae on palpus.
- Length of wing: an indication of specimen size.
- Number of anepimeral setae.
- Shape of tarsal claws: whether simple or toothed and whether tooth is strong or weak.
- Length of empodia relative to tarsal claws.
- Abdominal setation: number and placement of setae and scales on terga, pleura and sterna. Sternal setae are variable, but basically consist of groups extending across the width of each sternum, and a more cephalic group which is sometimes divided into three subgroups, two lateral and one central. In species with sparse setae, the central group is absent. Located anteriorly on each sternum usually is a pair of trichoid sensilla, but occasionally some species have only one sensillum and others none. Pleural setae are occasionally present and scales more commonly so, but, when present, are usually restricted to the apical abdominal segments.
- Length of ovipositor: this is given as a ratio or the length of tergum VII (as measured from basal trichoid sensilla to base of caudalmost seta on tergum) to that of the more rigid, distal half of the ovipositor.
- Shape of the male genitalia, particularly the shape of the basimere and telomere.

Pupal characters:

The pupa bears some good characters especially in the head armature which is presumably used for breaking out of the galls before the adult emerges. The useful characters are: the shape of the antennal horns, frontal ridges and pronotum, and the length of the pronotal setae.

Key to species of *Rhopalomyia* reared from *Artemisia tridentata* in Idaho

Although females of a few species and most males, if used alone, will run successfully in this key, a male and a pupa or pupal exuviae will be needed in many cases. *Rhopalomyia rugosa* is not keyed here because its male is unknown.

- | | | |
|----|---|----------------------|
| 1. | Claws toothed, palpus 1- or 2- segmented | 2 |
| | Claws simple, palpus 1-segmented | 18 |
| 2. | Palpus 2-segmented | 3 |
| | Palpus 1-segmented | 8 |
| 3. | Trichoid sensilla absent from abdominal sterna | |
| | <i>R. pomum</i> & <i>R. hirtipomum</i> | |
| | Trichoid sensilla present on at least some abdominal sterna | 4 |
| 4. | Abdominal sternum VII with one trichoid sensillum, remaining sterna without or with one or two sensillae | <i>R. calvipomum</i> |
| | Abdominal sterna II-VII each with 2 trichoid sensilla | 5 |
| 5. | Telomere or male genitalia truncate apically, basimere stout (Figs. 94-95); pupa with long, conical, antennal horns (Figs. 65-66) . | 6 |

- Telomere tapered gradually to apex, basimere narrow (Figs. 90-91);
pupa with short antennal horns (Figs. 67-68, 71-72) 7
6. Abdomen covered with scales; tooth of telomere narrow R. nucula
Abdomen without scales; tooth of telomere wide (Fig. 49) R. obovata
7. Basimere of male genitalia without a conspicuous dorsal lobe
(Fig. 91); pupal pronotum unmodified (Figs. 67-68)
. R. medusa & R. medusirrasa (in part)
Basimere stout, with a large ventral lobe (as in Figs. 92-93);
pupal pronotum produced anteroventrally (Figs. 71-72) R. tumidicaulis
8. Telomere of male genitalia subcylindrical, the tooth narrow
(Figs. 88-89) 9
Telomere ovoid, the tooth wider than long (Figs. 78-79) 10
9. Telomere of male genitalia tapering gradually to apex; pupal pronotum
produced anteroventrally (Figs. 63-64) R. mammilla
Telomere truncate apically (Figs. 88-89); pupal pronotum
unmodified, at least in culmata (anthoides pupa unknown)
. R. culmata & R. anthoides
10. Pupal antennal horn bifid apically (as in Fig. 45) R. hirtibulla
Pupal antennal horn with single apical point 11
11. Pupal antennal horns long, conical; frontal projections of pupa
short or absent (Figs. 49-50, 55-56) 12
Pupal antennal horns short; frontal projections strong (as in
Figs. 69-70) 13
12. Abdominal sterna without trichoid sensilla; pupal antennal horns
approximately as long as pronotal setae (Figs. 49-50) R. tubulus
Abdominal sterna with trichoid sensilla; pupal antennal horns
much longer than pronotal setae (Figs. 55-56) R. lignea
13. Pupal antennal horn strongly projected ventrally, pronotum
of pupa produced anteroventrally (Figs. 69-70) R. hirticaulis
Pupal antennal horn not projected ventrally, pronotum unmodified 14
14. Basimere of male genitalia with prominent ventral lobe (as in Fig. 85) 15
Basimere tapering gradually from base to apex 16
15. Palpal setae clustered near apex R. gossypina
Palpal setae randomly placed R. lignitubus
16. Pupae with prominent frontal protuberances (Figs 67-68)
. R. medusa & R. medusirrasa (in part)
Pupa with weak or no frontal protuberances (Figs. 57-58, 61-62) 17
17. Teeth of tarsal claws strong, occasionally bifid R. conica
Teeth of tarsal claws weak, simple R. cramboides
18. Telomere of male genitalia ovoid, the tooth wide 19
Telomere conical or cylindrical, the tooth very narrow 20
19. Abdominal sterna with trichoid sensilla; basimere of male
genitalia with a prominent ventral lobe R. florella
Abdominal sterna without trichoid sensilla; basimere without
a lobe, tapering gradually from base to apex (Figs. 82-83)
. R. ampullaria
20. Telomere of male genitalia conical (Figs. 80-81); pupal antennal horn
with a simple apical point and a basal spur (Figs. 51-52) R. tumidibulla
Telomere cylindrical, truncate apically (Figs. 76-77); pupal antennal
horn bifid, without an apical spur R. brevibulla

Rhopalomyia pomum Gagné

(Figs. 1, 2, 3, 4, 5, 6, 7, 73, 74, 75)

Rhopalomyia artemisiae (Felt) 1908:339, (nec R. artemisiae (Bouché) 1834.
Rhopalomyia pomum Gagné 1975:483 (new name for artemisiae Felt).

Diagnosis

Rhopalomyia pomum is one of a group of larger sagebrush midges that have 2-segmented palpi and toothed claws. It is very close to R. hirtipomum and R. calvipomum, which form the same general type of gall. The external anatomy of R. hirtipomum appears identical with R. pomum, but its gall has a very fuzzy surface and is always monothalamous. The adult differs from R. calvipomum by lacking trichoid sensilla at the cephalic end of most of the abdominal sterna, and the pupa has simple rather than bifid antennal horns.

Description

Male. Wing length, 2.6 - 3.1 mm. Eyes usually less than one facet diameter apart at vertex. Antenna 15-16 flagellomeres; neck flagellomere III, 0.53-0.59 length node; neck V, 0.60-0.72 length node; neck VII, 0.60-0.71 length node. Fused labella hemispherical in frontal view, 0-6 setae per labellum. Palpus 2-segmented, segment II usually about 0.5 length I, occasionally as long; 0-3 setae present per segment, scattered when present. Frontoclypeus with 3-11 setae per side. Anepisternum with 5-15 setae. Claws toothed, the teeth occasionally bifid. Empodia as long as claws. Abdomen: tergum III with 15-23 setae per side, V with 18-30, VI with 21-35, and VIII with 19-32, the caudal groups on all terga except VII and occasionally VIII not joined mesally; pleura I-IV without setae, V-VI with 0-2, VII with 1-8, and VIII with 5-13, occasional scattered scales sometimes present on distal segments; sterna without basal trichoid sensillae, sternum VII with 32-57 setae in distal groups and 28-50 in basal group, the latter usually separated into a mesal and two lateral groups. Genitalia (Figs. 73-75): basimere with prominent ventral lobe; telomere ovoid, tapering gradually to wide apical tooth; sternum X usually weakly bilobed.

Female. Wing length, 1.8-2.1 mm. Antenna with 14-16 flagellomeres; neck flagellomere III, 0.11-0.29 length node; neck V, 0.05-0.25 length node; neck VII, 0.00-0.30 length node; necks absent beyond V-IX. Other head and thoracic characters as in male. Abdomen: tergum III with 11-20 setae per side, V with 19-29, and VII with 12-23, the two groups on VII usually convergent mesally; pleura I-V without setae, VI with 0-4 setae, VII with 2-10, occasional scales sometimes present on distal segments; sterna without trichoid sensillae, sternum VII with 20-38 setae in distal group, 10-41 in basal, these usually disposed in the 3 groups, 1 mesal and 2 lateral; tergum VII 0.27-0.34 length distal half of ovipositor; setulae of the latter elongate, few pronged.

Pupa (as in Figs. 47-48). Antennal horn short, with a single point. Frons with pair of pointed, bilaterally compressed projection laterad of the clypeal base.

Lectotype here designated, male, #3120, emerged VI-16-1883, Fort Garland, Colorado, Artemisia tridentata, C 989, USNM Type No. 29260. Paralectotype, female, same data as lectotype.

Felt's type series, which does not include gall material is arbitrarily assigned to R. pomum rather than R. hirtipomum. These two species cannot be distinguished on the basis of adults. However, inasmuch as galls of R. pomum are much more commonly found in nature and thus adults of this species were more likely to have been before Felt when he described D. artemisiae, we believe our action is justifiable.

Galls typical of those of R. pomum were taken from A. arbuscula, nova, cana, and tripartita. Rhopalomyia specimens were reared from the first two plant species, but are different from R. pomum in that they have trichoid sensilla on the abdominal sterna.

Biology

Egg. The bright-red eggs were found in masses on the surface of developing persistent leaves between two unseparated leaves in the bud (Fig. 1) and on the inturned margins of a more developed leaf. Eight egg masses contained from 26-208 eggs (avg. 100.3). The dimensions of 84 eggs ranged from 0.18-0.29 mm in length (avg. 0.25) and 0.05-0.10 mm in width (avg. 0.08). At Site 1 eggs were evident from May 8 to 28, 1969, but could not be found on June 13. This suggests an ovipositional period of at least 20 days and a developmental period for individual eggs of less than 16 days.

Larva. Larvae were found at Site 1 from mid-October (coinciding with the first signs of gall) until mid-May. At the higher elevation Sites 2 and 3, they were also found in mid-October, but were still evident until the last of May.

Pupa. Pupae were observed in the field 15 days prior to the first observed adult emergence at Site 1, in 1969. Nine mature female pupae were found to contain 240-511 eggs (avg. 369.8).

Adult emergence. The monothalamous galls were the first to show midge emergence. Under field conditions emergence occurred as early as May 7, 1969 at Site 1 when a few fresh pupal exuviae were found. On May 28 some pupae were present at this site indicating that emergence was still in progress, but it was completed sometime prior to June 13. Examination of galls at Site 3 at a higher elevation showed that adult emergence had commenced no more than a few days prior to May 19, 1969. The host plants were at the same stage of seasonal development at all sites during midge emergence with the persistent leaves beginning to separate in the bud.

In the laboratory the earliest emergence of adults was on April 23, 1969 from galls collected on April 14 from A. t. tridentata at Site 20 at an elevation of 3140 feet. The latest seasonal rearing was July 2, 1968 from galls collected on June 25 from A. t. vaseyana f. spiciformis at Site 10 at an elevation of 6500 feet.

In all rearings of this species, more females emerged than males. Individual rearings of 182 similar appearing polythalamous galls from Sites 1-4 also had a preponderance of galls with only one sex (Table 3). Females (Fig. 1) emerged from 57.1% of the galls, whereas males (Fig. 2) emerged from 23.1%. Only 5.5% of the 182 galls had emergence of both males and females. No midge emergence occurred from the remaining 14.3% of the galls although parasitoids emerged from 23 of these 26 galls. Midge emergence occurred daily but only during the evening or early morning hours. Maximum emergence from an individual gall showed no great difference between the sexes. During a period of 14 days a total of 59 males emerged from 1 gall and during an 8 and 13 day period a total of 51 females emerged from each of two galls.

Caging studies to determine the specificity of R. pomum and galls were not successful. Midges emerging from polythalamous galls were caged on 18 plants; however, only 3 of these plants survived the summer after transplanting. One of these, an A. t. vaseyana plant, did subsequently form eight polythalamous and five monothalamous galls. These galls appeared the same as those caused by this midge species under normal field conditions. No galls were found on the other two surviving plants.

Daily activity begins with emergence of the adult from the gall. Although male emergence was not observed in the field, specimens were found at first light clinging to foliage indicating a possible predawn emergence. Female emergence begins before sunrise in early light. It is first evident when the dark head of the pupa breaks through the gall surface. The pupa works through the surface until half its body is protruding. A longitudinal split down the dorsal surface of the thorax then occurs through which the female emerges. The pupal exuvium (Fig. 3) remains attached to the gall. The female then

crawls to a nearby leaf or stem where the wings expand and dry. During this period the ovipositor remains fully extended.

The entire process of emergence was recorded for two individuals at Site 1 on May 11, 1969. The sequence of events and recorded time were as follows: pupal head broke through gall surface, 0700 and 0750; thoracic split occurred, 0720 and 0801; adult completely emerged, 0728 and 0807; and wings expanded, 0735 and 0810. Thus it took a total of 35 and 20 minutes respectively for these individuals to complete emergence.

Male flight. Each morning, flight of newly emerged males coincides with emergence of the first females. The males usually appear as a large group, but occasionally only a few individuals or single specimens are present. The groups are associated with gall bearing sagebrush plants and move from

Table 3. Sex variation in *Rhopalomyia pomum* from polythalamous galls collected from four sites in Twin Falls Co., Idaho, 1969.

Site	No. of Galls	Galls with emergence of			Galls with
		Females only	Males only	Both Sexes	No Emergence
1	50	32	13	2	3
2	32	14	3	2	13
3	50	33	10	1	6
4	50	25	16	5	4
Totals	182	104	42	10	26
Percent		57.1	23.1	5.5	14.3

one portion of a plant to another or to other plants in search of females. The searching flight appears to be concentrated about branches with or in the proximity of galls.

Activity of males as indicated by trap-board counts (Table 4) taken at Sites 2, 3 and 4 generally shed an increase after 0700 and a decrease after 0800. These counts indicate a relationship between male activity and temperature and light which was further indicated by observations. Very few males were observed in the later morning hours. They usually displayed a behavioral pattern consisting of frequent resting periods on foliage that lasted up to 20 seconds between periods of flight. Male flight behavior also was affected by wind during the two trapping periods at Site 4 when gusty conditions prevailed. Males flew between gusts and either rested on foliage or crawled about seeking females during gusts. Hourly wind recordings could not be correlated with the trapping results due to the variability of the wind velocities during each hour of a morning.

Mating. Females are ready to mate only when their wings are fully expanded. Teneral females discourage or prevent mating by body movement or by holding their genitalia against the plant surface. The female, if not mated

within 5-15 minutes after becoming receptive, crawls to another or more exposed place on the plant. She mates only once. Mated females can be recognized by having the ovipositor retracted and are usually found in less exposed places. Males occasionally were observed attempting to copulate with mated females but were unsuccessful because of movement of such females.

The male locates a receptive female during the course of a searching flight. Upon locating such a female he hovers over her briefly before mounting. In the copulatory position the head and thorax of the male are situated over the abdomen of the female and the male's abdomen is curved downward directly over or to the side of the female with their genitalia in contact. The pro- and mesothoracic legs of the male clasp the female while the metathoracic pair are in contact with the plant or extend in space. After mating a male resumes the searching flight.

Most males quickly attained the copulator position. When difficulty was encountered a male either departed or attempted to mate again. One male was observed trying to mate with the head of a female and on the side of her thorax. After much activity on the part of both individuals, the male flew a short distance, but returned immediately and then successfully mated. In another case a second male attempted to position himself on a mating pair. In still another case four males in succession attempted to mount a female being carried off by a worker harvester ant, Pogonomyrmex owyheeii Cole.

Observation of 34 pairs in copulation showed that copulation lasted from 20-35 seconds (avg. 27.5) under calm conditions. Under windy conditions four mating pairs required 35-45 seconds (avg. 41.3) for copulation.

Oviposition. Females oviposit about three hours after copulation. With a now partially extended ovipositor the female crawls up a stem in search of leaf growth where she backs into a bud with developing persistent leaves. The ovipositor is then fully extended and, after some testing and probing, eggs are deposited or the female departs to locate another bud. In one instance a female was observed "testing" a bud, then partially retracted her ovipositor and left, apparently because eggs were already present on the bud. Observations indicate that only after initial oviposition does the female fly to other branches or to other plants. By 1100 few females could be found on the plants although trapping records (Table 3) indicate continued activity after this time. With flight females become difficult to observe.

The number of eggs in nine virgin females ranged from 263-539 (avg. 410.7).

Gall

Description and development. This persistent leaf series gall is either monothalamous or polythalamous. The mature form varies from globose to distinctly irregularly lobed. The surface of the monothalamous galls is uniform while that of the polythalamous galls (Fig. 3) has both deep and shallow fissures giving the gall a lobed appearance. The color ranges from reddish to a common pattern of mottled reddish and greenish to completely green. The surface is covered with short trichomes. Often, monothalamous and polythalamous galls are present on the same plant (Table 5) with the latter usually predominatory. A total of 1185 galls (1166 polythalamous and 19 monothalamous) occurred on a sampled plant at Site 2.

Under the surface layer the gall consists of a spongy mass of interwoven fibers. Within this fibrous mass near the base of the gall are the sclerenchymatous larval capsules. A single fiber extends from the upper portion of each capsule to a small brown spot on the gall surface (Fig. 4).

One hundred fifty galls had a range of 13-45 mm (avg. 26) for their greatest diameter across the gall from its base. An opposing diameter at the widest point perpendicular to this diameter ranged from 12-40 mm (avg 20).

Table 4. Numbers of *Rhopalomyia pomum* adults entrapped hourly in relation to temperature and relative humidity for 2 days at Sites 2, 3, and 4, Twin Falls Co., Idaho, 1969.

Date	Recording	0600	0640	0700	0800	0900	1000	1100	1200	1300
Site 2										
22 May	Males	--	--	14	115	62	2	1	0	--
	Females	--	--	0	0	0	1	8	5	--
	Temperature (°F)	42	--	48	58	65	71	72	77	--
	Relative Humidity (%)	77	--	67	51	39	33	31	26	--
23 May	Males	--	--	43	53	7	1	0	0	--
	Females	--	--	0	2	2	10	8	4	--
	Temperature (°F)	48	--	55	68	72	76	79	82	--
	Relative Humidity (%)	66	--	59	42	38	31	31	28	--
Site 3										
26 May	Males	--	165	--	45	14	3	0	0	0
	Females	--	0	--	0	0	10	4	5	1
	Temperature (°F)	55	55	--	64	68	73	74	75	--
	Relative Humidity(%)	43	43	--	34	31	29	23	24	--
27 May	Males	--	85	--	98	8	1	0	0	--
	Females	--	0	--	0	1	1	0	8	--
	Temperature (°F)	55	58	--	59	57	62	63	66	--
	Relative Humidity (%)	43	46	--	42	45	41	42	36	--
Site 4										
29 May	Males	--	--	18	28	4	4	0	0	--
	Females	--	--	0	0	0	1	1	0	--
	Temperature (°F)	47	--	48	57	62	73	75	75	--
	Relative Humidity(%)	40	--	41	35	36	19	24	24	--
2 June	Males	--	--	19	29	2	0	0	0	--
	Females	--	--	0	0	0	1	1	0	--
	Temperature (°F)	48	--	50	59	68	73	77	76	--
	Relative Humidity (%)	54	--	49	47	34	32	26	25	--

Developing galls appear as small irregular swellings on either surface of a persistent leaf (Fig. 5). They have a dense covering of trichomes which gives them a gray color except for small brown spots on the surface which are free of trichomes. The galls were first observed on October 23, 1969 at Sites 1, 2 and 3. On March 18, 1970 an increased swelling of some galls was noted (Fig. 6) while all others appeared unchanged. At this date no ephemeral leaf development was evident.

Seasonal development was followed only at one location. At Site 1 greatest gall growth occurred during April with maximum size being attained by the end of the month. At this time the first whorl of ephemeral leaves was as long as the persistent leaves, stem growth was becoming apparent, and the galls were conspicuous. Later in May when midge emergence took place the galls and the persistent leaves had begun to dry and then were shed during July and August. However, galls in the more sheltered portions of the crown persisted for a year or more. Observations at other sites indicated that seasonal development varies with elevation.

Effect on the plant. At four sites where galls were abundant they were distributed throughout the plant crown (Table 5). The density of plants varied between these sites and some plants had few if any branches on certain sides. Plants at Site 4 were quite close with side branches touching those of neighboring plants while plants at the other sites were farther apart. Formation of a monothalamous gall affected only the one persistent leaf while formation of the polythalamous galls damaged the buds from which 31.02% of the galled leaves originated. This damage (Figs. 3, 7) resulted in distorted ephemeral leaves and a lack of stem growth. No plant or branch mortality was found to be the direct results of this gall formation.

Associated insects

Curculionidae: Apion sordidum Smith, commonly reared from galls, proved to be an inquiline. The larvae of this small dark weevil mine through the fiber mass and pupate in the gall. In rearing containers adults emerged at the same time as the gall midges or within a week after. One to several emerged from individual galls. They do not have any apparent adverse effect on the midges.

Nabidae. Early instar nymphs of Reduviolus alternatus Parshley were found in most plant materials after a few days in rearing. Six individuals were reared and were observed preying on midge pupae as they broke through the gall surface.

Formicidae. The harvester ant, Pogonomyrmex owyheei Cole, appeared to be a major predator of the adult midges.

Platygasteridae. Two species, Platygaster utahensis (Ashmead) and Platygaster sp. A. were reared from galls. The hosts of these parasitoids were not identified.

Chalcidoidea. The following parasitoids were commonly reared from galls. Torymus aeneoscapus Huber, Tetrastichus sp. and a species of Miscogasterinae. Their hosts were not identified.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bannock Co: .5 mi W McCammon, 4719 ft; Bear Lake Co: 3 mi N Georgetown, 6200 ft (specimen reared); Bingham Co: 15 mi NW Blackfoot; Blaine Co: 3 mi W Carey, 5150 ft (specimens reared); Boise Co: 7 mi S Horseshoe Bend, 4200 ft; 20 mi S Idaho City (specimens reared); Butte Co: 21 mi SW Arco, 6000 ft; 18 mi NE Howe, 5100 ft; Caribou Co: 2.5 mi E Wayan, 6750 ft; Cassia Co: 8 mi SE Albion, 5350 ft; 4 mi W Almo, 6300 ft

Table 5. Abundance, distribution, and impact of *Rhopalomyia pomum* galls on five plants at four study sites in Twin Falls Co., Idaho, 1969.

Site	Plant	Height	Crown Diameter		Number of Galls					Total		Destroyed
			Wide	Narrow	North	East	South	West	Center	Poly ¹	Mono ²	Bud
1	#3	54	86	56	97	30	32	27	111	235	62	123
	5	62	97	89	40	72	52	63	80	205	102	83
	6	62	93	73	14	33	111	NB	186	232	112	71
	7	47	86	62	22	67	38	22	55	94	120	40
	9	52	64	55	49	74	37	2	15	32	145	14
2	#1	89	82	36	34	320	415	109	307	1166	19	283
	3	84	97	67	39	118	92	23	92	336	28	99
	5	71	58	37	NB	70	61	6	198	334	1	159
	6	61	59	38	13	2	4	18	23	53	2	17
	9	59	63	38	47	197	NB	16	227	483	4	144
3	#1	41	51	47	254	148	54	76	186	633	85	142
	3	32	45	29	12	NB	9	4	47	71	1	35
	5	38	42	34	26	15	23	4	57	115	10	37
	6	44	56	29	32	9	6	20	10	67	10	20
	10	35	42	28	3	12	3	9	8	34	1	9
4	#1	49	47	26	0	NB	0	0	14	14	0	1
	3	62	72	34	0	0	0	2	41	37	6	15
	5	58	54	26	0	0	0	0	16	15	1	1
	6	49	44	39	0	1	1	0	20	17	5	6
	9	54	64	56	10	31	1	1	39	72	10	18

NB - No branches in quadrant, ¹Polythalamous Galls, ²Monothalamous Galls.

(specimen reared); 2.5 mi SE Basin, 4200 ft; 8 mi SE Malta, 4400 ft; Clark Co: 4 mi NE Argora, 7250 ft; 3.5 mi W Dubois, 5150 ft; 8 mi N Small, 5960 ft; Custer Co: 4 mi SW Clayton, 5000 ft; Elmore Co: 22 mi N Mt. Home, 4700 ft (specimens reared), 6 mi. W Hill City, 5400 ft; Franklin Co: 1.5 mi W Dayton, 4750 ft (specimens reared); Gooding Co: 5 mi W Hagerman (specimens reared); Lemhi Co: 1.5 mi E and 3 mi NE Baker; Lincoln Co: 4 mi W Dietrich, 4000 ft; 25 mi N Shoshone, 4960 ft; 5 mi NE Shoshone, 4700 ft (specimens reared); Madison Co: 9 mi W Rexburg, 4850 ft; Oneida Co: 6 mi N Stone; Owyhee Co: 6 mi S Grasmere, 5450 ft; 20 and 28 mi SW Marsing; 3 mi E Reynolds; 14 mi S Riddle, 5300 ft; Power Co: 14 mi W American Falls, 4400 ft; Twin Falls Co: 11 mi NW Buhl; 18 mi E Rogerson 5700 ft. (specimens reared); 8 mi SW Rogerson, 6200 ft. Lower Rock Creek Canyon (specimens reared); Washington Co: 4 mi N Midvale, 2544 ft. NEVADA: Washoe Co: 12 mi SW Reno.

A. tridentata tridentata: IDAHO: Butte Co: .5 mi W Arco, 5300 ft; Franklin Co: 1 mi W Dayton, 4700 ft (specimens reared); Gooding Co: 3 mi SE Bliss, 3140 ft (specimens reared); 9 mi W Bliss, 3000 ft (specimens reared); 515 mi E Gooding, 3800 ft; Lemhi Co: 3.5 mi E Leadore, 5850 ft; 16 mi N Salmon, 4000 ft; Lincoln Co: 11.5 mi W Kimama, 4275 ft (specimens reared); 10.5 mi NE Richfield, 4700 ft. (specimens reared); Minidoka Co: 2 mi E Acequia, 4200 ft. (specimens reared); Owyhee Co: 2 mi W Indian Cove, 2850 ft; Grasmere, 5126 ft; 4 mi NW Murphy, 2800 ft; 2 mi S Riddle, 5300 ft; Twin Falls Co: 6 mi S Bliss, 11 mi S Hansen, 4300ft (specimens reared); 6 mi NE Twin Falls, 3700 ft; 5 mi E Twin Falls, 3746 ft (specimens reared); 5.5 mi E Twin Falls 3650 ft (specimens reared); 23 mi SW Twin Falls, 4950 ft (specimens reared); MONTANA: Beaverhead Co: 6 mi E Bannock Pass Summit; 12 mi E Bannock Pass Summit; 17 mi E Bannock Pass Summit; WASHINGTON: Franklin Co: Palouse Falls State Park.

A. tridentata vaseyana: IDAHO: Blaine Co: above Galena Summit, 8900 ft (specimens reared); 15 mi NW Ketchum, 7500 ft; 6 mi S Ketchum, 5500ft (specimen reared); Camas Co: 5 mi N Fairfield, 5150 ft; 9 mi N Fairfield, 6000 ft; 12 mi S Fairfield, 5450 ft; Cassia Co: Elba-Basin Pass Summit; 8 mi W Elba, 6350 ft; 7 mi E Oakley; Custer Co: 5 mi NW Galena Summit, 7350 ft (specimens reared); 8 mi NW Mackay, 6200 ft (specimens reared); Pass Creek Summit 7633 ft; 2 mi S Stanley, 6100 ft (specimens reared); Gooding Co; 16 mi N Gooding, 5225 ft; Franklin Co: 3 mi W Dayton 4800 ft (specimens reared); Oneida Co: 9.5 mi W Malad 5200 ft (specimens reared); 11 mi W Malad; Owyhee Co: 2 mi N Riddle, 5400 ft (specimens reared); 6 mi N Riddle, 5500 ft; 7 mi E. Sheaville, Oregon (specimens reared); Twin Falls Co: 15 mi S Hansen, 4525 ft; 17 mi S Hansen, 4725 ft (specimens reared) 21 mi S Hansen, 5240 ft; 22 mi S. Hansen, 5700 ft (specimens reared); Magic Mt. Ski Area, 6400 ft; 17 mi E Rogerson, 5700 ft; Valley Co: 6 mi N Cascade, 4700 ft; MONTANA: Beaverhead Co: 1.7 mi E Bannock Pass Summit

A. tridentata vaseyana f. spiciformis: IDAHO: Camas Co: 11 mi N Fairfield, 6500 ft (specimens reared); 13 mi N Fairfield, 7000 ft.

Rhopalomyia hirtipomum Gagné, new species
(Figs. 9, 10, 47, 48)

Diagnosis

Rhopalomyia hirtipomum appears to be anatomically identical to R. pomum but is responsible for a slightly different gall. That of hirtipomum is densely covered with long trichomes, whereas that of R. pomum has short, prostrate, sparse trichomes on the surface. In addition, galls of the former are always monothalamous.

Description

Essentially as for R. pomum. Male genitalia as in Figs. 73-75; pupal head (Figs. 47-48).

Holotype, male, 1.2 mi W Washtucna, Adams Co., Washington, IV-16-1968, Artemisia tridentata tridentata, R. G. Jones, USNM Type No. 66624.

Biology

Seasonal occurrence. Overwintering immature larvae were collected on October 23, 1969 and mature larvae on April 23, 1969 at Site 1 from A. t. wyomingensis. Emergence of adults in the field was evident on April 28, 1970 at Sites 21 and 22 when both pupae and exuviae were found. In the laboratory, emergence occurred on April 19 and 20, 1969 from A. t. vaseyana f. xericensis galls collected on April 8 at Site 27. Midges emerged also on April 20 and 21, 1969 from A. t. wyomingensis galls collected on April 14 and on April 23, 1969 from galls collected on April 21 at Site 21.

Gall

Description and development. This monothalamous gall (Fig. 9) is globose and quite similar to the monothalamous gall of R. pomum. However, the gall surface is densely clothed with long trichomes, giving it a fuzzy appearance. The gall is generally solitary on either the upper or lower leaf surface, but can occasionally be found in confluent clumps (Fig. 10). Fifty-nine mature galls were measured: the diameter extending from the gall base ranged from 8-15 mm (avg. 12) and the diameter perpendicular to this ranged from 8-13 mm (avg. 11).

Developing galls were first found on October 23, 1969 at Site 1 on A. t. wyomingensis. They appeared as fuzzy swellings with diameters of 1-3 mm on a persistent leaf surface. The long, dense trichomes were white, while the surface of the gall was reddish. Galls had the same appearance on A. t. vaseyana f. xericensis when found at Site 27 on December 29, 1969. At both sites this appearance persisted until March, when growth resumed. As the gall grew, their surface coloration gradually changed to gray. Maximum size of the gall was found to coincide with the presence of pupae and with new stem growth of approximately 2.5 cm in length. Shedding of the galls occurred in July and August, at the same time as those of R. pomum.

Effect on the plant. There was no apparent detrimental effect observed from galls of this species.

Associated insects

Curculionidae. Apion sordidum is an inquiline in the gall of this midge species. It was reared from galls at most study sites.

Chalcidoidea. Torymus aeneoscapus and Tetrastichus sp. were reared commonly from galls collected at all study sites.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bear Lake Co: 9 mi S Dingle, 6300 ft; Cassia Co: 6 mi W Burley, 4240 ft (specimen reared); Owyhee Co: 27 mi S Bruneau, 4640 ft; Power Co: 4 mi W American Falls, 4400 ft; Twin Falls Co: 23

mi SW Twin Falls 4950 ft.

A. tridentata tridentata: IDAHO: Owyhee Co: 23 mi SW Grandview (specimens reared); WASHINGTON: Adams Co: 1.2 mi N Washtucna (holotype, male and male and 2 females, paratypes).

A. tridentata vaseyana f. spiciformis: IDAHO: Camas Co: 13 mi N Fairfield, 7000 ft.

A. tridentata vaseyana "f. xericensis": IDAHO Washington Co: 8 mi N Weiser, 2580 ft (specimens reared).

A. tridentata wyomingensis: IDAHO: Gooding Co: 9 mi W Bliss, 3000 ft (2 females, 2 pupae, 2 pupal exuvia; paratypes); 3 mi S Hagerman, 2964 ft (3 males, 3 females, paratypes); Lincoln Co: 12 mi W Kimama, 4275 ft; Twin Falls Co: 5 mi E Twin Falls, 3746 ft; Balanced Rock (specimens reared); 1 mi E Balanced Rock (male, paratype); Owyhee Co: 13 mi SE Murphy (2 females, 2 pupal exuvia, paratypes); Owyhee Co: 4 mi NE Reynolds (male, 5 females, 8 pupae, paratypes).

Rhopalomyia calvipomum Gagné, new species
(Figs. 8, 45, 46)

Diagnosis

This species is most similar to R. pomum and R. hirtipomum. Unlike those two species, adults of R. calvipomum have basal trichoid sensilla on the abdominal sterna and pupae have bifid antennal horns. All three species form the same general type of gall, but that of R. calvipomum is naked.

Description

Male. Wing length, 2.5-3.1 mm. Eyes closely approximate at vertex, usually less than 1 facet diameter apart. Antenna with 15 flagellomeres; neck flagellomere III, 0.57-0.60 length node; neck V, 0.61-0.70 length node; neck VII, 0.60-0.69 length node. Fused labella hemispherical in frontal view, sometimes indented mesally, 0-4 setae per labellum. Palpus 2-segmented, the segments subequal in length but II usually narrow; segment I with 2-4 setae, segment II with 0-2. Frontoclypeus with 6-16 setae per side. Anepisternum with 9-15 setae. Claws unidentate. Empodia as long as claws. Abdomen: tergum III with 17-22 setae per side, V with 19-30, VII with 25-35, and VIII with 21-30, the 2 groups on segments VII and VIII contiguous mesally; pleura I-III without setae, IV with 0-2, V with 0-3 and VI with 2-6 and VII and VIII with 6-15; sterna II-VI usually with trichoid sensillum, occasionally 1 or more sterna without or with 2, sternum VII with 1, VIII with none; sternum VII with 37-45 setae in distal group, 28-54 in basal group, these continuous across the sternum. Genitalia as for R. pomum (Figs. 73-75).

Female. Wing length, 1.7-2.1 mm. Antenna with 14-15 flagellomeres, neck flagellomeres III, 0.15-0.19 length node; neck V, 0.14-0.18 length node; neck VII, 0.07-0.14 length node; necks not present beyond VII or VIII. Other head and thoracic characters as in male. Abdomen: tergum III with 10-14 setae per side, V with 23-37, and VII with 22-27, the two lateral groups on VII almost contiguous mesally; pleura without setae on segments I-IV, pleura V-VI with 1-4, VII with 6-13. Sterna II-VI usually with one trichoid sensillum, occasionally 0-2; sternum VI with 1, rarely no trichoid sensillum, in which case preceding sternum with 1; sternum VII with 26-40 setae in distal group and 23-50 in basal group, the latter generally divided in 2 lateral and 1

mesal group; tergum VII 0.33-0.36 length distal half of ovipositor, the latter with elongate, few pronged setulae.

Pupa (Fig. 45-46). Antennal horn bifid, the mesal point slightly shorter than the lateral and usually hidden in side view. Frons with single pair of pointed, bilaterally compressed projections.

Holotype, male, 5 mi E Twin Falls, Twin Falls Co., Idaho, IV-14-1969, Artemisia tridentata tridentata R. G. Jones, USNM Type No. 66625.

Biology

Seasonal occurrence. Immature larvae were found in newly evident galls on A. t. wyomingensis at Site 21 on March 23, 1970. Mature larvae were present at Site 1 on May 9, 1969 on A. t. wyomingensis and at Site 17 on July 11, 1968 on A. t. vaseyana f. spiciformis. Collections of pupae were made on May 14, 1969 from A. t. wyomingensis at Site 1 and on July 11, 1969 from A. t. vaseyana f. spiciformis at Site 17. In the field, adult emergence from A. t. wyomingensis was underway on June 1, 1970 at Site 1 and 16 when both pupae and pupal exuviae were found. Emergence was completed the previous year at Site 1 before May 28. In 1970 emergence at Site 27 from A. t. vaseyana f. xericensis was completed sometime prior to June 2.

Gall

Description and development. The mature gall (Fig. 8) is globose to irregularly elongate and is similar to that of R. pomum in shape and by having small brown spots on the surface. It differs by being firmer and having a smooth surface that lacks trichomes.

One hundred fifty mature galls were measured: the diameter extending from the gall base ranged from 9-26 mm (avg. 15) and the diameter of the greatest width perpendicular to the previous measurement ranged from 8-20 mm (avg. 13).

Developing galls were evident on March 23, 1970 at Site 21. They appeared as a reddish or violet-colored swelling of a persistent leaf. At this time stem growth had not begun but the first whorls of ephemeral leaves were developing and expanding. Maximum size of the gall was found to coincide with the presence of pupae and with new stem growth approximately 7.5 cm in length. Galls fall from the plant in July and August, as do those of R. pomum.

Effect on the plant. Initiation of gall formation causes a deformation of leaf growth and prevents stem development at the given bud. At sites where abundant, the galls were found throughout the crown of all host plants, but no plant or branch mortality was evident.

Associated insects

Curculionidae. Apion sordidum was reared from galls at most study sites.

Platygasteridae. Platygaster utahensis and Synopeas sp. were reared from galls collected from Site 17 on A. t. vaseyana f. spiciformis.

Chalcidoidea. Several undetermined species of Tetrastichus were commonly reared from galls at nearly all study sites.

Host plants and distribution of specimens studied

Artemisia tridentata. IDAHO: Bear Lake Co: 9 mi S Dingle, 6300 ft (specimen reared); Boise Co: 7 mi S Horseshoe Bend, 4200 ft; Cassia Co: 8 mi SE Albion, 5350 ft; Clark Co: 20 mi NW Terreton, 4800 ft (specimen reared);

Custer Co: 5 mi E Clayton, 5650 ft; 32 mi NW Mackay; Lincoln Co: 4 mi N Dietrich, 4100 ft (specimens reared); Owyhee Co: 40 mi SE Bruneau; Teton Co: 3 mi S Driggs, 6150 ft (specimens reared); Twin Falls Co: 11 mi S Hansen, 4300 ft. NEVADA: Elko Co: nr. Dinner Station, Virgil Delegans (specimens reared, V-14-1969; 1 male, 5 females and 2 pupae, paratypes).

A. tridentata tridentata: IDAHO: Owyhee Co: 23 mi SW Grandview; Ada Co: 5 mi SE Boise (pupa, paratype).

A. tridentata vaseyana f. spiciformis: IDAHO: Franklin Co: 28 mi NE Preston, 6850 ft (specimens reared, VII-11-1968; 4 females and 2 pupae, paratypes).

A. tridentata vaseyana "f. xericensis": IDAHO: Washington Co: 8 mi. N Weiser, 2580 ft.

A. tridentata wyomingensis: IDAHO: Canyon Co: 15 mi S Nampa, 2500 ft; Elmore Co: 7 mi S Mt. Home, 3000 ft (specimens reared IV-21-1968; male and pupa, paratypes) 3 mi N Mt. Home, 3325 ft (specimens reared IV-21-1968; 3 males and 4 females, paratypes); Gooding Co: 9 mi W. Bliss, 3000 ft (4 pupae, paratypes); 3 mi S Hagerman, 2964 ft (pupa); Lincoln Co: 12 mi W Kimama, 4275 ft; Twin Falls Co: 5 mi E Twin Falls, 3746 ft (specimens reared V-14-1969; holotype, male, and 10 males, 10 females, 13 pupae, paratypes); 23 mi SW Twin Falls, 4950 ft; NE Balanced Rock (pupa).

Rhopalomyia tubulus Gagné, new species
(Figs. 11, 49, 50)

Diagnosis

The pupa of this species is similar to that of R. obovata and R. nucula except that its frontal projections are not as strong. Adults can readily be separated from those of the above two species by the 1-segmented palpus and the lack of basal trichoid sensilla on the abdominal sterna.

Description

Male. Wing length, 2.3-2.5 mm. Eyes contiguous at vertex. Antenna with 14-15 flagellomeres; neck flagellomere III, 0.47-0.53 length node; neck V, 0.43-0.52 length node; neck VII, 0.47-0.58 length node. Labella apparently not fused, ellipsoid-angular in frontal view, 1-2 setae per labellum. Palpus 1-segmented, elongate-ovoid, occasionally pointed apically, with 0-3 setae. Frontoclypeus with 3-4 setae. Anepisternum with 3-7 setae. Claws toothed, the teeth strong. Abdomen: tergum III with 7-9 setae per side, V with 8-11, VII with 11-16, and VIII with 8-12, the groups not contiguous mesally; pleura without setae but with many scales; sterna II-VIII without trichoid sensilla, sternum VII with 26-30 setae in distal group, 31-38 in basal. Genitalia: basimere with short basoventral lobe, telomere elongate-ovoid, tapering gradually from midlength to toothed apex.

Female. Wing length, 1.4-1.8 mm. Antenna with 14-15 flagellomeres, none with necks. Other head and thoracic characters as in male. Abdomen: tergum III with 8-11 setae per side, V with 9-17, and VII with 7-13, setal groups of terga not contiguous mesally; pleura without setae but with many scales; sterna II-VII without trichoid sensilla, sternum VII with 16-26 setae in distal group and 14-29 in basal, the latter either continuous across its sternum or separated into two lateral groups; tergum VII 0.36-0.38 length distalhalf of ovipositor.

Pupa (Figs. 49-50). Antennal horns long, conical, tapering gradually from base to pointed apex. Frons with two pairs of projections: a pair of

transverse ridges immediately caudad of the antennal bases, the anterior surface concave, the posterior convex; and a pair of pointed, bilaterally compressed projections laterad of the base of the clypeus.

Holotype, male, 9 mi W Bliss, Gooding Co., Idaho, IV-14-1969, Artemisia tridentata, R. G. Jones, USNM Type No. 66626.

Biology

Seasonal occurrence. Adults were reared on April 24, 1969 from galls collected April 14 at Site 21 and from May 15-19, 1969 from galls collected May 14 at Site 1.

Gall

Description and development. The mature gall is tube-shaped (Fig. 11). The surface is dark reddish and covered with the same white trichomes as on the normal leaf surface. The gall has a single larval chamber at the base, is hollow in the center and has a thin septum near the apex. The hollow portion is utilized by the pupa to facilitate escape, with the pupal exuvium remaining at the ruptured apical septum.

In appearance the developing gall differs only in size from that of the mature gall. Developing galls were found on March 23, 1970 at Site 21 on A. t. wyomingensis and on March 24 at Site 27 on A. t. vaseyana f. xericensis. All observable growth occurs during the spring with maximum size of the galls coinciding with the presence of pupae.

Twenty-three mature galls ranged in length from 2-6 mm (avg. 4.5) with diameters ranging from 1-2 mm (avg. 1.4).

Effect on plant. Galls were not abundant. Their formation affected only a small portion of an individual persistent leaf with no observable adverse effects.

Associated insects

Chalcidoidea. Tetrastichus sp. was reared from galls of R. tubulus and established as a parasitoid of this midge species.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Cassia Co: 6 mi W Burley, 4240 ft (female and pupa paratypes).

A. tridentata vaseyana "f. xericensis": IDAHO: Washington Co; 8 mi N Weiser, 2580 ft.

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt Home (pupa paratype); Gooding Co: 9 mi W Bliss, 3000 ft (holotype and male and 2 pupal exuviae, paratypes); Owyhee Co: 3 mi SW Walter's Ferry (9 males and 8 females, and 5 pupae paratypes); 4 mi NE Reynolds; Twin Falls Co: 8 mi N Roseworth, 4800 ft; 5 mi E Twin Falls, 3746 ft (2 males, 3 females, and 2 pupal exuvia paratypes).

Rhopalomyia rugosa Gagné, new species

Diagnosis

The male of this species is unknown, but the female can be separated from other tiny Rhopalomyia species with 1-segmented palpi and simple claws by the presence of the trichoid sensillum at the base of sternum VII and by the pupal antennal horn which has a well-developed basal spur.

Description

Male. Unknown.

Female. Wing length, 1.4-1.5 mm. Eye almost contiguous at vertex, less than 1/2 eye facet diameter apart. Antenna with 11-12 flagellomeres; neck flagellomere III 0.08 as long as node; necks indistinct beyond flagellomere IV. Fused labellum elliptic triangular, without setae. Palpus 1-segmented, elongate ovoid, without setae. Frontoclypeus with 3-4 setae per side. Anepisternum with 4-5 setae. Claws simple, empodia slightly shorter than claws. Abdomen: tergum III with 4-7 setae, V with 7-8, and VII with 8, the 2 caudal groups separated mesally; pleura without setae or scales; sterna II-VI usually each with 1 basal trichoid sensillum, 2 sometimes present, sternum VII with 1 basal trichoid sensillum, 14 setae in caudal group, and 8 in basal group, the latter separated into 2 lateral groups; tergum VII approximately 0.35 length ovipositor.

Pupa Antennal horn with single apical point and conspicuous basal spur. Frontal projection present.

Holotype, female, 23 mi S Hansen, Twin Falls Co, Idaho V-9-1968, Artemisia tridentata vaseyana, R. G. Jones, USNM Type No. 66627.

Biology

Seasonal occurrence. Two adults emerged within 2 weeks after galls were collected May 9, 1989 at Site 6.

Gall

Description. This monthalamous gall develops from the upper surface of a persistent leaf. The coloration and pubescence of the gall surface is similar to that of the unaffected leaf. At maturity it is prune-shaped. Internally, a central cavity is lined with sclerenchyma. Only two galls, both occurring on the same leaf, were found during this study. They were 4 mm in height and 2 and 3 mm respectively in diameter.

Host plants and distribution of specimens studied

Artemisia tridentata vaseyana: IDAHO: Twin Falls Co: 22 mi S Hansen, 5700 ft (holotype female, and female and pupal exuvia paratypes).

Rhopalomyia hirtibulla Gagné, new species
(Figs. 12, 78, 79)

Diagnosis

This is the only species of those forming small leaf bump or capsule galls on big sagebrush that has toothed claws. The pupa of R. hirtibulla has bifid antennal horns, and the frontal projections are either tiny or absent. Rhopalomyia clinata Gagné, which forms a small, different kind of leaf gall on Artemisia californica in California also has toothed claws, but its pupa is quite different because of single-pointed antennal horns and large frontal projections.

Description

Male. Wing length, 1.7-2.0 mm. Eyes separated at vertex by diameter of 1 eye facet. Antenna with 12-13 flagellomeres; neck flagellomere III, 0.60-0.70 length node; neck V, 0.67-0.80 length node; neck VII, 0.75-0.82 length node. Fused labella elliptic-ovoid in frontal view, naked. Palpus 1-segmented, ovoid to elongate-ovoid, with 0-1 setae. Frontoclypeus with 0-2 setae per side. Anepisternum with 1-4 setae. Claws strong with strong tooth, the tooth occasionally bifid. Empodia as long as claws. Abdomen: tergum III with 2-5 setae per side, tergum V with 4-6, VII with 6-8, and VIII with 4-7 the groups not contiguous mesally; pleura without scales, pleuron VIII with 0-3 setae; sterna II-VII each usually with basal pair of trichoid sensilla, though occasionally reduced to 0-1 on one or more sterna, sternum VII with 10-12 setae in caudal group, 12-15 in basal, these more or less continuous across sternum. Genitalia (Figs. 78-79): basimere short, stout, in profile narrowing gradually from wide base to slightly narrower apex; telomere short, ovoid, tooth fairly narrow; sternum X slightly concave apically.

Female. Wing length, 1.2-1.4 mm. Antenna with 10-13 flagellomeres; neck flagellomere III, 0.04-0.10 length node; neck V, 0.00-0.07 length node; necks indistinct beyond IV-VII. Other head and thoracic characters as in male. Abdomen: tergum III with 2-5 setae per side, V with 3-4, and VII with 5-6; pleura without scales or setae; sterna II-VII usually with basal pair of trichoid sensilla, sternum VII with 9-14 distal setae, 4-7 basal, this group divided mesally; tergum VII 0.28-0.31 length distal half of ovipositor.

Pupa. Antennal horn strongly developed, bifid apically, the inner projection subequal in length to or slightly shorter than outer projection. Anterior portion of frons immediately basad of antennal horn in lateral view raised above general surface of rest of frons; frons with or without short pair of lateral projections.

Holotype, male, 3 mi N Mt. Home, Elmore Co., Idaho, III-24-1969, Artemisia tridentata, R. G. Jones, USNM Type No. 66628.

Biology

Seasonal occurrence. Immature larvae were found at Site 15 on July 19, 1968 coinciding with the first sign of galls. Larvae were found throughout the rest of the year with mature larvae present the following spring. Adult emergence occurred on March 29, 1969 from galls collected March 24 at Site 15. In 1970, emergence occurred from March 27-29 from galls collected March 23.

Gall

Description and development. This small monothalamous gall (Fig. 12) occurs singly or in small to large confluent groups. The galls are densely clothed with long trichomes giving them a white fuzzy appearance. The mature gall is approximately 1 mm in diameter and of equal height. Emergence of the adult from a central larval chamber results in a small circular hole (Fig. 23) at the top of the gall.

Developing galls were first observed on July 19, 1968 at Site 15. They are similar in appearance to the mature galls. Growth was completed between that date and the end of March of the following year. Old galls remain on the plant until the persistent leaf series is shed.

Effect on the plant. These galls were always found concentrated on a small plant or on a single branch of a large plant. Such concentrations of galls gives the plants, especially those of small size an overall unthrifty appearance.

Associated insects

Platygasteridae. Platygaster sp. emerged from galls collected at Site 18 and was determined to be a parasitoid of this midge species. Another species of Platygaster, also a parasitoid, emerged from galls collected at Site 15.

Chalcidoidea. Tetrastichus sp. and a species of Pteromalinae and Encyrtidae were reared from galls, but their specific association of R. hirtibulla was not established.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Cassia Co: 4 mi W Almo, 6200 ft; Clark Co: 3.5 mi W Dubois, 5150 ft; Custer Co: 5 mi E Clayton, 5650 ft; UTAH: Salt Lake City (9 females).

A. tridentata tridentata: IDAHO: Butte Co: 7 mi E Howe (pupa, paratype); Cassia Co: City of Rocks (5 males, 3 females and 5 pupae, paratypes); 4 mi E Idahome, 4400 ft; Lemhi Co: 16 mi N Salmon, 4000 ft; MONTANA: Beaverhead Co: 17 mi E Bannock Pass Summit.

A. tridentata vaseyana: IDAHO: Franklin Co: 3 mi W Dayton, 4800 ft; Twin Falls Co: 22 mi S. Hansen, 5700 ft.

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (holotype, male, and 19 males, 11 pupae, paratypes); Owyhee Co: 3 mi SW Walter's Ferry.

Rhopalomyia brevibulla Gagné, new species
(Figs. 13, 76, 77)

Diagnosis

This species forms galls similar to those of R. hirtibulla except that they are not covered by long trichomes. Adults of R. brevibulla have the tarsal claws simple rather than toothed and quite distinctive male genitalia. The pupae of these two species are similar.

Description

Male. Wing length, 1.5-1.7 mm. Eyes separated at vertex by slightly more than the diameter of 1 eye facet. Antenna with 11-12 flagellomeres; neck flagellomere III, 0.55-0.63 length node; neck V, 0.63-0.70 length node; and neck VII, 0.55-0.60 length node. Fused labella hemispherical in frontal view, naked. Palpus 1-segmented, ovoid, with 0-1 setae. Frontoclypeus with 2-4 setae per side. Anepisternum without setae. Claws simple, strongly curved. Empodia as long as claws. Abdomen: tergum III with 1-2 setae per side, V with 2-3, VII with 2-4, and VIII with 0-3, the groups divided mesally; pleura naked; sterna without trichoid sensilla, sternum VII with 7-10 setae in caudal group, 7-14 in basal, these evenly distributed across sternum. Genitalia (Figs. 76-77): basimere only slightly larger basally than apically, unlobed; telomere elongate-ovoid, the tooth narrow, longer than wide, slightly recumbent; sternum X quadrate.

Female. Wing length, 1.4-1.5 mm. Antenna with 11-12 flagellomeres; neck flagellomere III, 0.10-0.11 length node; neck V, 0.10-0.12 length node; necks absent beyond V or VI. Other head and thoracic characters as in male. Abdomen: tergum III with 0-1 setae per side, V with 2-3, and VII with 3-4; pleura naked; sterna without trichoid sensilla, sternum VII with 8-10 setae caudally, 5-7 basally; tergum VII ca. 0.40 length distal half of ovipositor.

Pupa. Antennal horn weakly bifid, the inner projection shorter than outer. Anterior portion of frons immediately basad of antennal horns in lateral view raised above general surface of rest of frons; frons with weak pair of lateral projections.

Holotype, male, 3 mi N Mt. Home, Elmore Co, Idaho, III-18-1970, Artemisia tridentata wyomingensis, R. G. Jones, USNM Type No. 66629

Biology

Seasonal occurrence. Numerous females were observed ovipositing at 55°F on A. t. wyomingensis at 1100 hours on March 23, 1970 at Site 15. Their red eggs were readily found at the base of leaves, in crevices on overwintering branch tips and on twigs. Galls were collected at this time for laboratory rearing. Adults emerged over the following two days.

Gall

Description. This small monothalamous gall (Fig. 13) is similar in size and structure to that of R. hirtibulla. The grayish surface of the mature gall is clothed with trichomes the same as on the leaf. The galls occur singly or in large clusters both on the persistent leaf series and stems of the previous year's growth. Adult emergence holes are similar to those of R. hirtibulla (Fig. 12). The galls have been found on only one small plant at the type locality.

Host plants and distribution of specimens studied

Artemisia tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (2 males, 3 females, 3 pupal exuvia, paratypes).

Rhopalomyia tumidibulla Gagné, new species
(Figs. 15, 51, 52, 80, 81)

Diagnosis

Rhopalomyia tumidibulla belongs to a large artificial group of species with 1-segmented palpi and simple claws, but the male has a distinctive, strongly attenuate telomere and the ovipositor is fairly short. The pupal antennal horns are unique in that they are strongly bifid and have a ventrobasal spur.

Description

Male. Wing length, 2.5-2.6 mm. Eyes separated at vertex by about 1 facet diameter. Antenna with 13 flagellomeres; neck flagellomere III, 0.53-0.62 length node; neck V, 0.59-0.73 length node; neck VII, 0.62-0.76 length node. Fused labella small, ellipsoid, each labellum with 0 or 1 setae. Palpus 1-segmented, long-ovoid, tapering to apex, bearing 0 or 1 setae. Claws simple, strongly curved and well developed. Empodium slightly shorter than claws. Abdomen: tergum III with 9-11 setae per side, tergum V with 7-21, tergum VII with 9-13, and tergum VIII with 4-9, the caudal groups of setae not contiguous mesally; pleura without scales, pleuron VIII with 4-6 setae; sterna II-VII each with a basal pair of trichoid sensilla; sternum VII with 20-24 setae in distal group, 20-24 in basal group, these continuous across width of sternum. Genitalia (Figs. 80-81): basimere short, stout, in lateral view tapering gradually from wide base to apex; telomere long, strongly attenuate from base to narrow apical tooth; sternum X truncate apically.

Female. Wing length, 1.9 mm. Antenna with 12 flagellomeres; neck flagellomere III, 0.09 length node, necks indistinct beyond flagellomere II or IV. Other head and thoracic characters as in male. Abdomen: tergum III with 11 setae per side, tergum V with 14-16, and tergum VII with 8-9, the 2 caudal groups not contiguous mesally; pleura without scales, pleuron VII with 3 setae; sterna II-VII each with 2 basal trichoid sensilla, sternum VII with 19-23 setae in caudal group, 7-8 in basal group which is separated mesally; tergum VII approximately 0.39 length distal half of ovipositor.

Pupa (Figs. 51-52). Antennal horn with bifid apical projection and strong basal spur. Frons with pair of angular, bilaterally compressed projections.

Holotype, male pupa (with enclosed, fully developed male), 3 mi N Mt. Home, Elmore Co., Idaho, III-18-1970, Artemisia tridentata wyomingensis, R. G. Jones, USNM Type No. 66630.

Biology

Seasonal occurrence. Adults emerged in the laboratory on March 25-26 from galls that had been collected March 18, 1970. In the previous year's rearing, they emerged on April 24-25 from galls collected April 22, 1969. Adult emergence was not observed in the field.

Gall

Description. This monothalamous gall, when mature, consists of a swelling that is apparent on both surfaces of a persistent leaf (Fig. 15). A sclerenchymatous larval capsule is located centrally within the leaf

swelling. Two mature galls measured 3 mm in depth, 3 mm across the leaf width and 4 mm along the leaf length.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Cassia Co: 4 mi W Almo, 6200 ft (male, female, paratypes).

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (holotype male and 2 males, pupa, and pupal exuvium, paratypes).

A. tridentata vaseyana: IDAHO: Twin Falls Co: Magic Mt. Ski Area (2 females and pupa, paratypes).

Rhopalomyia spp.

Several minute, capsular, monothalamous leaf galls other than those of the last three named species were found in this study. They are not named here because adults either were not reared from them, or two or more apparent midge species were taken from the same type of gall. The few pupae and males taken from these galls are distinct from those of the preceding leafgall formers. The gall types were as follows:

1. An elongate, capsular gall with a very dense coat of short trichomes, which gives the surface a white appearance (Fig. 14). In clusters the galls superficially resemble bird droppings. They were found only once on an unthrifty of A. t. vaseyana plant growing under a juniper tree 4 mi W of Almo, Cassia Co., Idaho.

2. A gall about 1.0 mm long, 0.5 mm wide, with a thin, translucent yellow-brown outer wall. This gall was found in April on the leaves of A. t. vaseyana at the following Idaho localities: Blaine Co: 6 mi S Ketchum, 5500 ft (specimens reared); Camas Co: 12 mi S Fairfield, 5450 ft (specimens reared); Custer Co: 8 mi NW Mackay, 6200 ft (specimens reared); Twin Falls Co: 22 mi S Hansen, 5700 ft (specimen reared).

3. A similar appearing early spring gall found on one occasion on the bud axils of new growing branch tips of A. t. wyomingensis, 7 mi S. Mt. Home, Elmore Co., Idaho and on two occasions in the center of open buds of A. tridentata, 11.5 mi W Kimama, Lincoln Co., Idaho and 6 mi E. Bannock Pass Summit, Beaverhead Co., Montana. Only females were reared from these galls.

4. A gall similar in form, size, and structure to the preceding, but differing in that the translucent wall is sparsely covered with long trichomes. It was found 17 mi E of Bannock Pass Summit, Beaverhead Co., Montana.

5. A slightly larger leaf gall than the three preceding, and with an internal sclerenchymatous larval capsule about 1.0 mm in length and 0.5 mm in diameter. It was found at several localities in Idaho on Artemisia tridentata: 4 mi W Almo, 6200 ft., Cassia Co. (specimens reared; 3.5 mi W Dubois, 5150 ft, Clark Co; 3 mi W Dayton, 4800 ft, Franklin Co. and 2 mi E Acequia, 4200 ft, Minidoka Co (specimens reared).

Rhopalomyia ampullaria Felt
(Figs. 16, 17, 53, 54, 82, 83)

Rhopalomyia ampullaria Felt 1916e:185.

Diagnosis

Rhopalomyia ampullaria is a small species with simple claws, 1-segmented palpi, lacking trichoid sensilla on the abdominal sterna, and otherwise sparsely setose. It is easily separated from its most similar congeners by the long, unlobed male basimere, narrow-toothed, ovoid telomere, and the weakly developed claws.

Description

Male. Wing length, 1.7-1.8 mm. Eyes almost contiguous at vertex, less than 1 facet diameter apart. Antenna with 10-12 flagellomeres; neck flagellomere III, 0.52-0.62 length node, neck V, 0.52-0.75 length node, neck III, 0.64-0.71 length node. Fused labella ellipsoid in frontal view, with 0-1 setae per labellum. Palpus 1-segmented, elongate-ovoid, with 0-3 setae. Frontoclypeus with 1-6 setae per side. Anepisternum with 2-5 setae. Claws simple, strongly curved. Empodium approximately as long as claws. Abdominal tergum III with 3-4 setae; V with 3-7; VII with 4-6; and VIII with 3-4; lateral groups of setae not contiguous mesally. Pleura without setae but with scattered sclae. Sterna II-VIII without trichoid sensilla; sternum VII with 12-15 setae in distal group, 11-14 in basal group, this either broken mesally or continuous across sternum. Genitalia (Figs. 82-83): basimere tapering gradually from base to apex, not very setose, not lobed; telomere short, ovoid, tooth narrow, approximately as wide as long; sternum X truncate, the leading edge slightly concave.

Female. Wing length, 1.3-1.6 mm. Antenna with 10-13 flagellomeres; necks on basal flagellomeres either indistinct or less than 0.10 length node. Other head and thoracic characters as in male. Abdominal tergum III with 2-19 setae; V with 4-20; and VII with 3-13; lateral groups of tergal setae not contiguous mesally. Pleura without setae; distal segments with a few scattered scales. Sterna without trichoid sensilla; sternum VII with 6-14 setae in distal group, 6-18 in basal, these separated mesally into two groups. Tergum VII 0.26-0.30 length distal half of ovipositor.

Pupa (Figs. 53-54). Antennal horn not greatly produced. Spurs present ventrobasally. Frons with pair of acute, angular, bilaterally compressed projections.

Lectotype: here designated, female, reared VII-6-1913, near Salt Lake City, Utah, Artemisia tridentata, P. H. Timberlake, C1618, in Felt Collection. Paralectotype: pupal exuvia, same data as lectotype.

Biology

Seasonal occurrence. This species has two generations per year. The summer generation develops in galls principally on ephemeral leaves while the overwintering generation develops in galls on flower buds.

The eggs of the summer generation were not found. The bright red eggs of the overwintering generation were present singly or in small clusters of two-five on the surface of young flower heads, usually protected by the subtending bract, stem or by another flower head. An average of three eggs

per cluster occurred at 36 oviposition sites.

Immature larvae of the summer generation were found on A. t. tridentata at Site 1 on May 14, 1969 when the ephemeral leaf galls were first evident. Mature larvae were found on July 24, 1969 at Site 13. Immature larvae of the overwintering generation were present at Site 13 on September 23, 1969 when galls in the flower bud were first apparent. This generation reached larval maturity by March 19, 1970.

Pupal exuvia were found protruding from leaf galls at Site 13 on July 20, 1969. Midge emergence at this site was then followed through August 5. In 1968 emergence had occurred at the same site sometime between July 26 and August 13. On both July 20, 1969 and July 26, 1968 the ephemeral leaves of the sagebrush plants were found to be drying and Chrysothamnus viscidiflorus (Hook), an associated shrub species, was in early bloom while the flower buds of C. nauseosus (Pall.), another associated shrub species, were turning yellow. Field emergence of the overwintering generation was not followed.

Under laboratory conditions, adult emergence from ephemeral leaf galls collected July 16, 1969 at Site 13 occurred from July 23 through 28. Emergence began on July 30 and continued through August 5 from galls with pupae collected on July 23-28. Adult emergence from galls in flower buds collected at the same site March 19, 1970 occurred from March 27 through 31.

Ninety leaves placed in individual rearing containers had an average of 4.08 galls with a range from 1-22 galls per leaf. Midge or parasitoid emergence occurred from 107 galls on 44 leaves. Examination of 174 galls on 36 leaves after midge emergence showed the contents of 19 unaccounted for and 83.9% of the midges in the remaining gall had been parasitized.

Three virgin adult females of the summer generation contained from 142-172 eggs (avg. 160.7) and 1 mature female pupa contained 171 eggs.

Emergence. Female emergence on August 1, 1969 at Site 13 began at sunrise or shortly after 0600 at a temperature of approximately 50°F. The emergence of one individual was complete in 24 minutes from the time the pupa broke through the pointed apex of an ephemeral leaf gall. This activity was similar to that described for R. pomum with the pupal exuvia remaining attached to the gall. No male emergence was observed.

Male flight. Flight activity of newly emerged males as indicated by trapping (Table 6) began at about sunrise in temperatures above 50°F. Up to 134 males were caught on a single trap board surface. Flight activity lasted for approximately 2 hours.

Oviposition. Four ovipositing females were observed at 0850 on August 1 and another at 1045. From the limited observations made, oviposition of R. ampullaria appears similar to that of R. pomum and differs only in the specific ovipositional site and in the number of eggs deposited.

Description and development. The monothalamous gall caused by the summer generation of this midge occurs singly or in confluent groups, predominantly on the ephemeral leaves (Fig. 16) and only occasionally on flower bracts and stems (Fig. 17). The mature gall is woody and consists of a rounded base on one surface of a leaf and a conical portion on the opposite surface. The gall surface has the same color and dense covering of trichomes as a normal leaf. A larval chamber is centrally located in the base and is separated by a thin septum from the conical portion which is hollow. The apex of the conical portion is membranous. The conical portion of 67 mature galls ranged from 2-7 mm (avg. 4.18) in height and 1-3 mm in width at the leaf surfaces.

Gall

The flower bud gall of the overwintering generation is not readily visible. The affected buds remain closed during bloom and the gall can be found only by forcing open the involucre bracts. An elongate

Table 6. Numbers of Rhopalomyia ampullaria adults entrapped hourly in relation to temperature and relative humidity for three days at Site 13, Cassia Co., Idaho, 1969.

Date	Recording	0600	0700	0800	0900	1000	1100	1200
29 July	Males	--	223	25	3	0	0	0
	Females	--	0	3	4	3	0	0
	Temperature (°F)	62	60	66	70	77	81	81
	Relative Humidity (%)	64	78	71	59	52	41	50
1 August	Males	--	31	33	1	0	0	--
	Females	--	0	0	1	0	0	--
	Temperature (°F)	50	52	67	73	77	79	--
	Relative Humidity (%)	49	57	41	35	26	25	--
5 August	Males	--	3	11	3	0	0	--
	Females	--	0	0	0	1	0	--
	Temperature (°F)	54	54	56	58	63	67	--
	Relative Humidity (%)	48	37	34	32	33	30	--

sclerenchymatous larval capsule with a dense covering of long white trichomes replaces the flower. During the period of full bloom the capsule is green but after bloom the gall becomes translucent and colored much like that of the dry involucre bracts. By the summer following adult emergence, all galls have dropped from the plant. The few mature galls measured were approximately 2 mm in length and 1 mm in width.

Developing galls on ephemeral leaves were first observed on May 14, 1969 at Site 1 on A. t. tridentata. At this time new stem growth was about 7.5 cm in length. Galls had attained maximum size by July 24 coinciding with the presence of pupae. At that time the old persistent leaves, if present, were dry, new persistent leaves were well-developed and distinctly tridentate, the ephemeral leaves were mature and the flower heads of Chrysothamnus viscidiflorus were yellow but not open. The galls persist on the plants for only a short time after adult emergence. By the first of September during early bloom the ephemeral leaves become dry and are shed.

Effect on the plant. Although most ephemeral leaves on many plants at Site 13 had one to many galls, the plants appeared thrifty. The development of galls in the flower buds prevent flower and seed formation.

Associated insects

Chalcidoidea. Several parasitoid species were reared from the galls, including Torymus koebelei (Huber), Tetrastichus sp., a species of Pteromalinae and a species of Encyrtidae.

Host plants and distribution of specimens studied

A. tridentata: UTAH: Salt Lake City (Type-series ampullaria).

Artemisia tridentata tridentata: IDAHO: Cassia Co: 4 mi W Almo, 6200 ft (specimens reared); Lincoln Co: 11.5 mi W Kimama, 4275 ft; Twin Falls Co: 11 mi S Hansen, 4300 ft; 5 mi E Twin Falls, 3746 ft; 23 mi SW Twin Falls, 4950 ft.

A. tridentata vaseyana: IDAHO: Cassia Co: 4 mi W Almo, 6200 ft (specimens reared); 8 mi W Almo, 6300 ft; 8 mi W Elba, 6350 ft; Twin Falls Co: 21 mi S Hansen, 5240 ft; 17 mi S Hansen, 4725 ft; 22 mi S Hansen, 5700 ft

A. tridentata wyomingensis: IDAHO: Cassia Co: 4 mi W Almo 6200 ft.

Rhopalomyia culmata Gagné, new species (Fig. 18)

Diagnosis

This medium-sized species shows a resemblance to R. cramboides and other bud gallmakers on the basis of toothed claws, one-segmented palpus, and shape of the pupal head. However, the male genitalia are similar to those of R. obovata and R. nucula.

Description

Male. Wing length, 2.4-2.6 mm. Eyes separated at vertex by less than 1 facet diameter. Antenna with 14 flagellomeres. Fused labella short-ellipsoid, 0-2 setae per side. Palpus 1-segmented with 0-2 setae.

Frontoclypeus with 4-10 setae per side. Anepisternum with 3-4 setae. Claws toothed. Empodia slightly shorter than claws. Abdomen: tergum III with 12-13 setae per side, V with 12-14, VII with 11-13, and VIII with 10-14 setae, the setal groups not contiguous mesally; pleura I-II with many scales, III-VII naked, VIII with 5-8 setae, sterna II-VII with basal pair of trichoid sensilla, sternum VII with 18 setae in caudal group, 21 in basal, these continuous across sternum. Genitalia: basimere short with large basoventral lobe; telomere widest at about midlength, truncate apically, the tooth short, narrow; sternum X truncate.

Female. Wing length, 2.0 mm. Antenna with 13 flagellomeres, their necks indistinct beyond VIII-IX. Other head and thoracic characters as in male. Abdomen: tergum III with 9-16 setae per side, V with 13-16, and VII with 8-11; pleura I-II with many scales, other pleura naked; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 16-17 setae in caudal group, 16-18 in basal, these continuous across sclerite; tergum VII approximately 0.40 length distal half of ovipositor.

Pupa. Antennal horns short, the posteroventral corner weakly produced. Frons with short ridge immediately caudad of each antennal horn and with pair of triangular projections lateral of clypeal base.

Holotype, male, 3 mi N Mt. Home, Elmore Co., Idaho, IV-18-1972, Artemisia tridentata wyomingensis, Barr, Gagné and Gillespie, USNM Type No. 66631.

Biology

Seasonal occurrence. Pupal exuvia were found on a gall on May 27, 1969 at Site 3. Adults were reared April 21-26, 1972 from galls collected April 18 at Site 15.

Gall

Description and development. This monothalamous gall appears to be associated with one of the first ephemeral leaves that develop in the bud. The mature gall consists of a long, thin erect stalk with an enlarged apex made up of the fused lobes of the leaf tip (Fig. 18) surrounding a sclerenchymatous larval capsule. Some galls have a whorl of spatulate leaves at the base of the stalk. Two galls that were measured had stalks 10 mm long and the enlarged apical portions 5 mm long by 2 mm wide.

Host plants and distribution of specimens studied

Artemisia tridentata tridentata: IDAHO: Twin Falls Co: 23 mi SW Twin Falls, 4950 ft (pupal exuvia).

A. tridentata vaseyana "f. xericensis": IDAHO: Washington Co: 8 mi N Weiser, 2580 ft.

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (holotype, male, and male, 3 females, and 5 pupal exuvia, paratypes).

Rhopalomyia gossypina Gagné, new species (Figs. 19, 20, 84, 85)

Diagnosis

This species has a 1-segmented palpus and toothed claws as do most

sagebrush midges. The pupa has short antennal horns and frontal projections similar to many of the other bud gall makers, but the large basal lobe of the male basimere sets R. gossypina apart. The pointed palpus with its many setae arranged around the apex is also distinctive for the adult.

Description

Male. Wing length, 2.4-2.7 mm. Eyes contiguous at vertex. Antenna with 16-17 flagellomeres; neck flagellomere III, 0.67-0.72 length node; neck V, 0.76-0.80 length node; neck VII, 0.73-0.77 length node. Fused labella hemispherical in frontal view, usually with apical indentation; each labellum with 5-10 setae. Palpus 1-segmented, elongate-ovoid, usually tapering abruptly to pointed apex, with 5-13 setae near apex. Frontoclypeus with 5-7 setae per side. Anepisternum with 8-13 setae. Claws strong, toothed, the teeth small and narrow. Empodia as long as claws. Abdomen: tergum III with 15-21 setae per side, V with 22-26, VII with 20-28, and VIII with 16-31, scales interspersed with setae on terga VII and VIII and a few on disk of VIII; pleura II-V with 0-1 seta, VI with 304 setae, VII with 5-0, and VIII with 9-15, scales numerous on pleura VI-VII, occasional on others; sterna II-Vii each with basal pair of trichoid sensilla, sternum VII with 21-27 setae in distal group and 31-39 in basal, the latter group continuous across the sternum. Genitalia (Figs. 84-85): basimere in lateral view with very large basal lobe; telomere elongate-ovoid, tooth wide; sternum X margin truncate to slightly concave.

Female. Wing length, 1.8-2.0 mm. Antenna with 15-16 flagellomeres, necks indistinct. Other head and thoracic characters as in male. Abdomen: tergum III with 15-21 setae per side, V with 15-22, and VII with 16-20, the two groups on tergum VII contiguous mesally or nearly so; pleura I-V naked, VI with 0-1 setae, VII with 2-4, and VIII with 7-8, the two last segments with a few scales; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 27-34 setae in distal group and 11-14 in basal group which is divided mesally; tergum VII 0.35-0.38 length distal half of ovipositor.

Pupa. Antennal horn short, the apex projecting ventrally. Frontal projections short.

Holotype, male, 2 mi E Acequia, Minidoka Co., Idaho, IX-11-1969, Artemisia

Biology

Seasonal occurrence. In the field, adults began emergence prior to September 15, 1969 at Site 24. Emergence was still in progress on September 23. Adults were reared for two consecutive years from galls collected at Site 24. Emergence from galls collected September 6, 1969 occurred from September 10-16, but no emergence took place from an August 26 collection of galls. Emergence from galls collected September 11, 1969 occurred from September 13-20.

Individual rearing of 50 galls from the 1969 collection indicates a similar emergence phenomenon to that of R. pomum. Only male midges emerged from 12 galls and only females from another 12 galls. Both males and females emerged from only 3 galls. Because many galls did not have an adults emerge, all 50 galls were subsequently dissected. The galls each contained from 1-19 sclerenchymatous larval capsules (avg. 4.4). The contents of 216 of the capsules were accounted for with midges having emerged from 34.3% and parasitoids in or emerged from 65.7%.

A large number of galls with emerging midges was placed in three cages each containing a potted A. t. tridentata plant. These plants were transferred to a greenhouse in late October 1969. On January 20, 1970 four

galls were found developing on one of the plants. These galls were typical of those found in the field.

Emergence. Daily activity begins with emergence of the adult from the gall. Emergence is similar to that of R. pomum differing only in that the pupae wiggle through the long trichomes after breaking from the capsule. The pupal exuvia remain attached to these trichomes (Fig. 19).

At Site 24 female emergence began about two hours after sunrise at 40°F on September 15. No males emerged. Females began emerging at sunrise on September 18, 1969 at approximately 50°F while earlier males were observed clinging to foliage.

Male flight. Each morning, a flight of newly emerged males coincided with female emergence (Table 7). The males flew about the gallbearing branches in search of females, mating, and then flying on. This activity was similar to that of R. pomum. Males occurred singly or in mating groups of 2-4. While most activity was completed within two hours, a few males were observed in flight more than three hours after these activities had begun. One male began flight at 45°F but all other observed flight was at 50°F or above. The wind was generally calm during the study period.

Mating. Females were ready to mate after their wings expanded. Females mated once, whereas males were observed to mate with more than one female. The copulatory position was similar to that of R. pomum with 12 pairs copulating for periods ranging from 11 to 25 seconds (avg. 17.9). After copulation the females retracted their ovipositors and then rested on the foliage.

Oviposition. Oviposition activities begin with the female crawling to the buds and ovipositing quite like the female of R. pomum. With the first egg mass deposited, the female flies to a nearby branch or another plant. On September 18 at Site 24, three females that had emerged about 0730 and mated about 0820, began ovipositing about 1000. Few females were observed by 1200 each day, and none was seen by 1300. The bright red eggs of this species were found on one occasion in masses between the bases of two persistent leaves on the outside surface of developing leaves in the bud. Ten egg masses contained from two to 65 eggs, with an average of 42 per mass. Three virgin adult females contained 115-250 eggs (avg. 187) and one mature female pupa contained 208 eggs.

Gall

Description and development. This gall is a composite growth of the branch tips and buds (Fig. 19). At maturity it consists of 2-4 short, malformed, developing stems that are grouped in a globose mass of white trichomes from which green leaves protrude. The surface of these stems is densely clothed with white trichomes which are longer than the linear leaves arising from these stems. Hidden by the dense trichome mass, sclerenchymatous larval capsules are on the axis of the stems. These capsules are elongate cylinders with a rounded apex and a thin hard wall. The galls are generally found concentrated on one branch.

Fifty mature galls ranged in height from 8-15 mm (avg. 11.68). Their width ranged from 8-16 mm (avg. 12.88). Five of the larval capsules were approximately 2 mm in height and 1 mm in width.

Early development of this gall was noted on June 5, 1969 at Site 24. The immature gall is recognized as a mass of white trichomes subtended by a whorl of developing ephemeral leaves at the tip of a developing stem. At this time the normal stems were up to 20 cm in length, the flower branches were not yet distinctive, and the persistent leaves were just out of the bud. The galls increase in size during the summer and reach what appears to be maximum size in late August when the ephemeral leaves begin to dry. The galls remained

Table 7. Numbers of *Rhopalomyia gossypina* adults entrapped hourly in relation to temperature and relative humidity for three days at Site 24, Minidoka Co., Idaho, 1969.

Date	Recording	0700	0800	0900	1000	1100	1200	1300
15 September	Males	--	0	1	7	2	1	0
	Females	--	0	0	1	1	1	1
	Temperrature (°F)	33	34	45	53	61	63	68
	Relative Humidity (%)	80	81	51	52	31	29	27
17 September	Males	--	0	18	6	0	0	0
	Females	--	0	0	0	2	3	2
	Temperature (°F)	46	45	61	65	73	76	76
	Relative Humidity (%)	86	68	54	52	35	34	38
18 September	Males	--	27	25	0	0	0	0
	Females	--	0	0	0	1	2	0
	Temperature (°F)	49	52	65	74	78	78	83
	Relative Humidity (%)	73	69	48	36	30	33	28

unchanged in appearance after adult emergence and throughout the winter. The following spring the trichomes on the gall surface become drab. The old galls persist up to two years and perhaps longer in sheltered parts of the plant.

Effect on the plant. All the seasonal growth from a branch tip is utilized in gall formation with exception of the first ephemeral leaves. When galls are present in large concentrations on the plant, branch or even plant mortality occurs.

Most of the branches of one plant observed during the summer of 1968 carried old or developing galls. The following season the few remaining healthy branches had developing galls and all the other branches were devoid of foliage (Fig. 20).

Associated insects

Curculionidae. One specimen of Apion sordidum emerged on September 29 from one of the 50 galls placed in rearing on September 11, 1969.

Tephritidae. Oxyna palpalis (Coquillett) was reared from galls collected at three of the four sites where R. gossypina occurred. The exception was Site 3. The larvae burrow in the basal region of the gall. No apparent damage occurred to the midge chambers, but most feeding takes place after midge emergence.

Platygasteridae. Platygaster sp. was found to parasitize the midge. This species emerged in rearing concurrent with midge emergence and for about a week after.

Chalcidoidea. Several species including Torymus aeneoscapus were reared from the galls. Some are known to have parasitized R. gossypina but associations of the others are unknown.

Host plants and distribution of specimens studied

Artemisia tridentata tridentata: IDAHO: Butte Co: 7 mi E Howe; Cassia Co: 2.5 mi SE Basin, 4200 ft; Lincoln Co: 10.5 mi NE Richfield, 4700 ft; Minidoka Co: 2 mi E Acequia, 4200 ft (holotype and 26 males, 19 females, and 3 pupal exuvia, paratypes); Twin Falls Co: 23 mi SW Twin Falls, 4950 ft.

Artemisia tridentata vaseyana: IDAHO: Blaine Co: Big Wood River, 10 mi SE Bellevue.

Rhopalomyia lignea Gagné, new species (Figs. 21, 55, 56)

Diagnosis

The pupal antennal horns of R. lignea are the longest of all the A. tridentata gall midges but are similar to those of R. betheliana Cockerell, a species reared from A. frigida in Colorado. These two species are similar in other respects also in the lack of projections on the pupal frons and the sparse setae, 1-segmented palpi, and number of flagellomeres of the adults. They are readily separated by the relative length of the pupal pronotal setae which are much shorter in R. lignea and by the fact that the claws are toothed in R. lignea, simple in R. betheliana.

Description

Male. (only teneral specimens available). Antenna with 15 flagellomeres. Fused labella with one pair of setae. Palpus 1-segmented, elongate-ovoid, setose. Frontoclypeus with three setae per side. Claws each with small tooth. Empodia approximately as long as claws. Abdomen: tergum III with 18 setae, V with 17, VII with 14, and VIII with _____; pleura naked; sterna II-VII each with two basal trichoid sensilla. Genitalia: basimere wide at base, tapering gradually to narrower apex; telomere ovoid, the tooth wide; sternum X truncate apically.

Female. Eyes almost contiguous at vertex. Antenna with 14 flagellomeres; neck flagellomere III, 0.06 length node; neck V, 0.04 length node; neck indistinct beyond flagellomere V. Fused labella with two pairs of setae. Palpus as in male. Frontoclypeus with four setae per side, V with 15, and VII with 8, the lateral groups not contiguous mesally; pleura naked; sterna II-VIII each with basal pair of trichoid sensilla, sternum VII with 16 setae in distal group, 15 in basal, the latter divided mesally; tergum VII approximately 0.33 length distal half of ovipositor.

Pupa (Figs. 55-56). Antennal horns very long, tapering gradually to apex. Frons smooth. Pronotal setae short.

Holotype: male pupa, 8 mi NW Mackay, Custer Co., Idaho, III-22-1968, Artemisia tridentata vaseyana, R. G. Jones, USNM Type No. 66633.

Biology

Seasonal occurrence. Adults emerged from galls in the laboratory within two weeks of their collection on April 22, 1968 at Site 14.

Gall

Description. This bud gall (Fig. 21) is a confluent mass of swollen leaf rudiments which are green and densely covered with trichomes. Each leaf rudiment tapers from a broad base to a blunt apex, becomes woody at maturity, has a single larval chamber at the base, is hollow in the center, and has a thin septum at the apex that bears a mass of long trichomes. The hollow portion is utilized by the pupa to facilitate escape. The pupal exuvium remains at the ruptured septum. The old galls persist on the plant indefinitely. Three mature galls had a respective length of 8, 6, and 8 mm with a basal width of 4, 4, and 6 mm.

Effect on the plant. The formation of these galls marked the end of any normal growth from the buds. However, these galls were never abundant enough to cause any significant damage to sagebrush plants.

Host plants and distribution of specimens studied

Artemisia tridentata tridentata: IDAHO: Twin Falls Co: 11 mi S Hansen, 4300 ft.

A. tridentata vaseyana: IDAHO: Custer Co: 1 mi NW Mackay, 6200 ft (IV-22-1968, holotype, male pupa, and 1 male pupa and 1 female, paratypes); 2 mi N Riddle, 5400 ft.; Twin Falls Co: 17 mi E Rogerson, 5700 ft.

Rhopalomyia sp. near lignea
(Fig. 22)

Diagnosis

The two females (the only available specimens) resemble those of R. lignea by their large size (2.0-2.1 mm), 1-segmented palpus, weak-toothed claws, and presence of a basal pair of trichoid sensilla on each of the abdominal sterna II-VII. Because their galls are distinct from those of R. lignea we are treating this as a separate species. We lack males and pupae to make proper comparisons, and thus it is not being named at this time.

Biology

Seasonal occurrence. Immature larvae were found at Site 23 on August 28, 1969, in newly developing galls. Adults emerged April 20 and 21, 1969 from galls collected at that site on April 19.

Gall

Description. This reddish gall (Fig. 22) with a sparse trichome covering is generally similar to that of R. lignea. It occurs singly or in a confluent mass of leaf rudiments. It is elongate with a broad base and tapering to a blunt apex, which has a prominent swelling. A larval chamber is present at the base and the center is hollow. As with R. lignea the hollow portion is utilized in emergence.

Developing galls were first found on August 28, 1969 at Site 23. The galls reached maximum size prior to the presence of pupae on April 17, 1969. With maturity the galls are woody and persist on the plant for many years after adult emergence. Three mature galls from A. t. tridentata had a length of 5 mm and a basal width of 3 mm while a fourth was 6 mm long with the same width.

Effect on the plant. All growth from the bud is utilized in gall formation; however, the galls were never abundant or concentrated so no overall detrimental effect was observed.

Host plants and distribution of specimens studied

Artemisia tridentata tridentata: IDAHO: Cassia Co: 6 mi. NE Malta, 4400 ft; Lemhi Co: 16 mi N Salmon, 4000 ft; Lincoln Co: 11.5 mi W Kimama, 4275 ft (IV-20-1969, 2 females); 10.5 mi NE Richfield, 4700 ft; Minidoka Co: 2 mi E Acequia, 4200 ft.

Rhopalomyia lignitubus Gagné, new species
(Figs. 23, 24)

Diagnosis

This species is most similar to R. gossypina in its 1-segmented palpus, toothed claws, and large-lobed basimere; however, the palpal setae are not clustered near the apex of the palpus and the tarsal claws are more strongly developed in R. lignitubus than they are in R. gossypina. Both species have pupae that are similar to most of the other large bud gallmakers.

Description

Male. Wing length, 3.1 mm. Eyes less than 1 facet diameter apart at vertex. Antenna with 17 flagellomeres; neck flagellomere III, 0.50 length node; neck V, 0.53 length node; neck VII, 0.55 length node. Fused labella hemispherical in frontal view with apical indentation, 1-3 setae per labellum. Palpus 1-segmented, elongate-ovoid to fusiform, with 2-5 setae. Anepimeron with 11-13 setae. Claws toothed, teeth strong; empodia as long as claws. Abdomen: tergum III with 18-19 setae per side, V with 24-28, VII with 17-24, and VIII with 15-25; pleura I-V naked, VI-VIII with 1-6 setae, and VIII with 11-14 setae and several scales; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 30-48 setae in distal group, 36-45 in basal. Genitalia: basimere short with large mesoventral lobe; telomere ovoid with wide tooth; sternum X truncate apically.

Female. Wing length 1.9 mm. Antenna with 13-15 flagellomeres; necks flagellomeres III, V, VII, 0.05-0.10 length respective nodes; necks indistinct beyond VII-VIII. Anepimeral setae, 3-4. Other head and thoracic characters as in male. Abdomen: tergum III with 12-14 setae per side, V with 12-19, and VII with 17-25; pleura I-V naked, VI-VII with 1-7 setae and no scales; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 27-32 setae in caudal group, 5-14 in basal, the latter group separated mesally; tergum VII 0.36 length distal half ovipositor.

Pupa. Antennal horns short, simple, with short caudoventral prominences. Frons with ridges immediately caudal of antennal horns and with pair of small projections lateral of clypeal base.

Holotype, male, 6 mi W Burley, Cassia Co, Idaho, IV-22-1968, Artemisia tridentata, R. G. Jones, USNM Type No. 66634.

Biology

Seasonal occurrence. Immature larvae were found at Site 27 on March 8, 1970 coinciding with the first sign of gall development. Pupae were found on May 14, 1969 at Site 1 on A. t. tridentata and at Site 4 on May 29, 1969 on A. t. vaseyana. Adults emerged May 19, 1969 from galls collected on May 14 at Site 1. A pupal exuvium was found at the apex of each gall's hollow portion.

Gall

Description and development. This bud gall (Fig. 23) develops in the spring when plant growth begins. It is green and appears to be made up of a series of fused leaves that form a woody, hollow structure that is open apically. The inner surface of the gall is densely clothed with long trichomes while the outer surface is covered with shorter trichomes. The base

of the gall contains a single larval chamber. Some developing galls (Fig. 24) are short and dark reddish. After adults emergence the woody gall dries and persists on the plant for a year or longer.

Eighteen mature galls from A. t. vaseyana "f. xericensis" and A. t. wyomingensis ranged in length from 10-19 mm (avg. 12). The basal diameter ranged from 4-6 mm (avg. 4). Three galls from A. t. tridentata had respective lengths of 15, 17 and 25 mm and all with a basal diameter of 3 mm.

Effect on the plant. This gall formation ends normal growth from a bud but was never found abundant enough to cause branch mortality.

Associated insects

Chalcidoidea. A species of Tetrastichus was reared from this gall type.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Cassia Co: 6 mi W Burley, 4240 ft (holotype, male, and pupal exuvium, paratype); Gooding Co: 9 mi W Bliss, 3000 ft; Twin Falls Co: 5 mi E Twin Falls, 3746 ft (male, female, paratypes).

A. tridentata tridentata: IDAHO: Lincoln Co: 11.5 mi W Kimama, 4275 ft; Owyhee Co: Hot Creek Falls (3 pupae, paratypes).

A. tridentata vaseyana: IDAHO: Twin Falls Co: 17 mi S Hansen, 4725 ft.

A. tridentata vaseyana "f. xericensis": IDAHO: Washington Co: 8 mi N Weiser, 2580 ft.

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (3 pupae paratypes); Gooding Co: 9 mi NW Bliss (pupa, paratype); Lincoln Co: 12 mi W Kimama (pupa, paratype); Owyhee Co: 3 mi SW Walter's Ferry (2 pupae, paratypes); Twin Falls Co: 8 mi N Roseworth, 4800 ft (female, paratype).

Rhopalomyia cramboides Gagné, new species (Figs. 25, 26, 57, 58, 86, 87)

Diagnosis

Rhopalomyia cramboides is a fairly large species with 1-segmented palpi and toothed claws. The pupa resembles that of R. gossypina and R. anthoides, two other species that are responsible for cabbage-like galls on Artemisia plants. The three species differ from one another mainly in the male genitalia: R. cramboides has a small basimeral lobe unlike the large one found in R. gossypina and a short-ovoid, wide-toothed telomere as compared to the humpbacked, narrow-toothed one of R. anthoides.

Description

Male. Wing length, 2.5-2.9 mm. Eyes less than 1 facet diameter apart at vertex. Antenna with 13-14 flagellomeres; neck flagellomere III, 0.74-0.81 length node; neck V, 0.77-0.81 length node; neck VII, 0.76-0.84 length node. Fused labella small, hemispherical in frontal view, 0-4 setae per labellum. Palpus 1-segmented, elongate-ovoid, with 0-3 setae. Frontoclypeus with 2-5 setae per side. Anepimeron with 4-7 setae. Claws toothed, tooth weak. Abdoment: tergum III with 6-10 setae per side, V with 7-13, VII with 10-17, and VIII with 6-12, and few scales interspersed with setae on the last, and the 2 setal groups not contiguous; pleura II-VI naked, VII with 2-3 setae, and

VIII with 6-8 setae and several scales; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 22-28 setae in distal group and 24-30 in basal. Genitalia (Figs. 86-87): basimere long, tapering fairly gradually from wide base to narrower apex, with small, distinct lobe at distal two-thirds; telomere elongate-ovoid, tooth wide; sternum X concave apically.

Female. Wing length, 1.4-1.8 mm. Antenna with 11-13 flagellomeres; neck flagellomere III, 0.19-0.22 length node; necks V, VII 0.18-0.21 length node; necks indistinct or absent beyond IX. Other head and thoracic characters as in male. Abdomen: tergum III with 3-5 setae per side, V with 7-9, and VII with 6-8, the setal groups not contiguous mesally, pleura II-VI naked, VII with 0.2 setae and no scales; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 10-15 setae in distal group and 14-17 in basal, the second group divided into three distinct subgroups; tergum VII 0.28-0.31 length distal half of ovipositor.

Pupa (Figs. 57-58). Antennal horns short, the posteroventral corner weakly produced. Frons with short ridge present immediately caudal of each antennal horn and with small pair of frontal projections lateral of base of clypeus.

Holotype, male, 4 mi W Almo, Cassia Co., IV-22-1969, Artemisia tridentata vaseyana, R. G. Jones, USNM Type No. 66635.

Biology

Seasonal occurrence. Pupae were collected on April 22, 1969 at Site 13. At this time the first pair of ephemeral leaves was developing but not yet separate in the bud. In the field adults had emerged by May 6, 1969 at Site 13, and pupal exuviae were still attached to the galls. Adults emerged on April 24, 1969 from galls collected on April 22 at the same site. The earliest collections of immature larvae were on June 2, 1969 at Site 4 and June 30, 1969 at Site 13.

Galls with emerging adults were caged with three individually potted plants of A. t. vaseyana on April 25, 1969. By early September, five galls, similar in appearance to galls found in the field, were found developing on one plant. No gall development occurred on the other plants.

Gall

Description and development. This gall develops from the buds forming on new stem growth. It has a broad base made up of several whorls of fused and stunted leaves subtended by a pair of normal ephemeral leaves (Fig. 25). The outermost leaves are as wide as long while the inner leaves are oblong. The gall is green and normally covered with trichomes. The sclerenchymatous larval capsules in the mature gall are located at the bases of the innermost leaves at the stem apex. These galls are commonly found in clusters on a single branch.

Fifty mature galls had a width (diameter at widest point) ranging from 5-12 mm (avg. 9) and a height (base of gall to leaf apices) ranging from 5-12 mm (avg. 8). There are 1-8 sclerenchymatous capsules per gall (avg. 3).

The developing galls, containing early instar larvae, differ from mature galls only in size. The gall usually attains maximum size by winter although some growth may occur in the following spring. After midge emergence the galls begin to dry and within a year the leaves are lost but the galls persist indefinitely as dark, woody bodies on branch tips of the plants.

Effect on the plant. A large concentration of galls on a branch causes branch mortality (Fig. 26). Although no plant mortality was observed, several

plants had lost half or more of their main branches.

Associated insects

Tephritidae. Oxyna palpalis was a common inhabitant of these galls at Site 13. Larvae occurred from at least August 1968 until May 1969 in the developing galls. On June 14, 1968 approximately 40 of 100 galls from which midges had emerged contained prepupa or pupa of this species. Only one gall was found where apparent damage to the midge larvae occurred.

Chalcidoidea. Several species were reared from this gall type, including Torymus aeneoscapus, Tetrastichus sp. and a species of Pteromalinae. We could not establish which were parasitoids of the midge and which were associated with O. palpalis.

Platygasteridae. Platygaster sp. emerged from a gall collected on A. t. tridentata at Site 9 but from no other collections.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bear Lake Co: 12.4 mi E Montpelier, 6350 ft; Cassia Co: City of Rocks (female, paratype); Clark Co: 4 mi NE Argora; Teton Co: 3 mi S Driggs, 6150 ft; Twin Falls Co: 18 mi E Rogerson, 5700 ft.

A. tridentata tridentata: IDAHO: Butte Co: .5 mi E Arco, 5300 ft (2 females, paratypes); Minidoka Co: 2 mi E Acequia, 4200 ft.

A. tridentata vaseyana: IDAHO: Cassia Co: 4 mi W Almo, 6200 ft. (holotype, male, and 7 males, and pupa, paratypes); Twin Falls Co: 17 mi S Hansen, 4725 ft (specimens reared); 22 mi S Hansen, 5700 ft; Rock Creek Canyon (3 males, pupal exuvium, paratypes).

Rhopalomyia anthoides Gagné, new species (Figs. 27, 28, 88, 89)

Diagnosis

The bud galls of R. anthoides superficially resemble those of R. florella. The adults however, are quite different in the shape of the male genitalia; also the tarsal claws are toothed in R. anthoides and single in R. florella. Adults are similar to those of R. culmata, which makes a gall on the ephemeral leaves.

Description

Male. Wing length, 2.6-2.9 mm. Eyes less than 1 facet diameter apart at vertex. Antenna with 15-16 flagellomeres; neck flagellomere III, 0.61-0.65 length node; neck V and VII, 0.62-0.70 length node. Fused labella elipsoid, almost triangular, in frontal view, each labellum with 2-4 setae. Palpus 1-segmented, elongate-ovoid, with 1-2 setae. Frontoclypeus with 4-7 setae per side. Mesanepimeron with 7-15 setae. Claws toothed, the teeth occasionally bifid. Empodia slightly shorter than claws. Abdomen: tergum III with 11-21 setae per side, V with 11-20, VII with 12-19, and VIII with 11-15, the two groups on VIII contiguous mesally; pleura I-VII naked, VIII with 5-8 setae and a few scattered scales; sterna II-VII each basal pair of trichoid sensilla, sternum VII with 20-25 setae in distal group, 18-33 in basal, these continuous across sternum. Genitalia (Figs. 88-89): basimere short, stout, tapering

gradually from base to apex; telomere large, elongate-cylindrical, tooth narrow, longer than wide; sternum X truncate.

Female. Wing length, 2.3-2.9 mm. Antenna with 15-17 flagellomeres; neck flagellomere III, 0.20-0.30 length node; neck V, 0.14-0.26 length node; neck VII, 0.12-0.21 length node; necks indistinct beyond VIII-IX. Other head and thoracic characters as in male. Abdomen: tergum III with 10-20 setae per side, V with 12-21, and VII with 8-16; pleura I-VI naked, VII with 4-6 setae and no scales; sterna II-VII each with basal pair of trichoid sensilla; sternum VII with 19-28 setae in distal group and 14-36 in basal the latter group usually divided mesally; tergum VI 0.34-0.42 length distal half ovipositor.

Pupa. Antennal horns short, the posteroventral corner weakly produced. Frons with short ridge present immediately caudal of each antennal horn and with small pair of frontal projections lateral of clypeal base.

Holotype, male, 3 mi N Mt. Home, Elmore Co., Idaho, III-24-1969, Artemisia tridentata, R. G. Jones, USNM Type No. 66636.

Biology

Seasonal occurrence. Immature larvae were found June 10, 1968 at Site 15 coinciding with the first sign of gall development. The larvae appeared to have reached maturity by late November or early December and completely filled their individual sclerenchymatous capsules.

In the field, adults had emerged before April 14, 1969 at Site 15 from A. t. wyomingensis. Adults emerged from March 21 to 26, 1970 from galls collected at the above site on March 18 and or March 28-29 from galls collected at Site 6 on A. t. vaseyana.

Gall

Description and development. This bud gall has a seasonal occurrence similar to that of R. cramboides. In appearance it differs by being longer and less rounded and in structure by having the leaves composing the rosette more linear. In addition, the long outer leaves surround the shorter leaves of the gall base. All leaves of this gall on A. t. wyomingensis have a proliferation of long trichomes especially at their base (Fig. 27) while the leaves on A. t. vaseyana gall have a trichome proliferation only on the inner leaves (Fig. 28).

Eighty-four mature galls from A. t. wyomingensis at Sites 15 and 16 had a basal diameter ranging from 4-15 mm (avg. 8) and a height (length of outer leaves) ranging from 5-17 mm (avg. 11). Fifty-nine of these galls had 1-49 sclerenchymatous larval capsules (avg. 4).

Developing galls differ from mature galls mainly in size. Maximum size of the gall appears to be attained by winter. Following adult emergence in spring the galls dry out and darken in color but persist on the plant a year or longer.

Effect on the plant. With the formation of this gall all normal bud growth ceases. Several small branches were found filled by the concentration of many galls, but no major branch mortality was observed.

Associated insects

Tephritidae. Oxyna palpalis is a common inquiline in the galls of R. anthoides. Up to five puparia of this inquiline were found in old galls.

Chalcidoidea. The following were reared from this gall: Torymus aeneoscapus, Tetrastichus sp., a species of Pteromalinae and a species of

Encyrtidae. Their specific hosts were not established.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bear Lake Co: 9 mi S Dingle, 6300 ft, Butte Co: 21 mi SW Arco; 6000 ft; Camas Co: 6 mi W Hill City, 5400 ft; Clark Co: 3.5 mi W Dubois, 5150 ft; 8 mi N Small, 5960 ft; Elmore Co: 9 mi W Bliss, 3000 ft; Madison Co: 9 mi W Rexburg, 4850 ft; Owyhee Co: 27 mi S Bruneau, 4650 ft; 5 mi E. Murphy, 2900 ft; 14 mi S Riddle, 5300 ft; Twin Falls Co: 8 mi SW Rogerson, 6200 ft; NEVADA: Washoe Co: 12 mi SW Reno, UTAH: Cache Co: 20 mi E Logan.

A. tridentata tridentata: IDAHO: Butte Co: .5 mi W Arco, 5300 ft; Owyhee Co: 2 mi S Riddle, 5300 ft; WASHINGTON: Garfield Co: 14 mi W Clarkston.

A. tridentata vaseyana: IDAHO: Camas Co: 11 mi N Fairfield, 6500 ft; Twin Falls Co: 17 mi S Hansen, 4725 ft (2 females, paratypes); 21 mi S Hansen, 5240 ft; 22 mi S Hansen, 5700 ft (2 males, 2 females, paratypes); 17 mi E Rogerson, 5700 ft.

A. tridentata vaseyana f. spiciformis: IDAHO: Camas Co: 16 mi N Fairfield, 7000 ft.

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (2 females, paratypes); 7 mi S Mt. Home, 3000 ft (holotype, male).

Rhopalomyia florella Gagné, new species
(Figs. 29, 59, 60)

Diagnosis

Rhopalomyia florella is quite distinct from the other three species that form generally similar galls, viz. R. cramboides, R. anthoides and R. gossypina. Unlike the other species, adults of R. florella have simple tarsal claws with the males having a short but prominent mesoventral lobe on the basimere. The pupa is unique because of the ventrobasal spur on the antennal horn.

Description

Male. Wing length, 1.9-2.1 mm. Eyes contiguous at vertex. Antenna with 14 flagellomeres; neck flagellomere III, 0.48-0.53 length node; neck V, 0.52-0.61 length node; neck VII, approximately 0.56 length node. Fused labella ellipsoid, with 5-9 setae. Palpus 1-segmented, elongate-ovoid, with 2-4 setae. Frontoclypeus with 8-17 setae. Anepisternum with 13-16 setae. Claws strongly curved, simple. Empodia as long as claws. Abdomen: tergum III with 9-11 setae per side, V with 9-13, VII with 16-20, and VIII with 14-16 setae and a few scales, of VII and VIII contiguous mesally; pleura I-V naked, VI with 2-3 setae, VII with 4-7, and VII with 12-14 setae and several scales; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 16-20 setae in caudal groups, 14-17 in basal, these continuous across sternum. Genitalia: basimere with small mesoventral lobe at base, narrow beyond; telomere ovoid with wide tooth, sternum X slightly concave apically.

Female. Wing length, 1.1-1.2 mm. Eyes almost contiguous at vertex. Antenna with 12 flagellomeres; necks short to indistinct, none beyond flagellomere III. Labella without setae. Palpus with 0-3 setae. Frontoclypeus with 4 setae per side. Anepisternum with 4-5 setae. Frontoclypeus with 4 setae per side. Anepisternum with 405 setae. Abdomen: tergum III with 507 setae, V with 6-8, VII with 5-7; pleura naked; sterna

II-VII usually with two basal trichoid sensilla, sternum VII with 11-15 setae in caudal group, 7-10 in basal; tergum VII 0.20-0.25 length distal half ovipositor.

Pupa (Figs. 59-60). Antennal horn with short, ventrally pointed apex and long caudoventral spur. Frons short with two lateral projections.

Holotype, male, 3 mi N Mt. Home, Elmore Co., Idaho, III-25-1970, Artemisia tridentata wyomingensis, R. G. Jones, USNM Type No. 66637.

Biology

Seasonal occurrence. Adults emerged on March 25 and 26, 1970 from galls collected on March 18 at Site 15.

Gall

Description. This rosette bud gall (Fig. 29) is similar to that of R. anthoides. In general structure and in plant parts affected it appears identical. However, it differs by having the inner leaves similar in length to the leaves of the outer whorls. In addition, galls on both A. t. vaseyana (Fig. 29) and A. t. wyomingensis have a proliferation of long trichomes on all leaves. In size the gall of R. florella is about the same as the smaller galls of R. anthoides.

Effect on the plant. All normal growth from a bud is terminated with gall formation. Concentrations of old dry galls persisting on plants indicate that some small branch mortality is caused.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Owyhee Co: 40 mi SE Bruneau

A. tridentata tridentata: IDAHO: Butte Co: 7 mi E Howe (7 females, 2 pupal exuvia, paratypes).

A. tridentata vaseyana: IDAHO: Owyhee Co: 2 mi N Riddle, 5400 ft.

A. tridentata wyomingensis: IDAHO: Butte Co: 8 mi E Arco (male, 4 pupal exuvia, paratypes); Elmore Co: 3 mi N Mt. Home, 3325 ft. (holotype male, 4 males and 2 females, paratypes).

Rhopalomyia conica Gagné, new species (Figs. 30, 31, 61, 62)

Diagnosis

This species closely resembles R. cramboides with its 1-segmented palpus, toothed claws, and short basimeral lobe. The tarsal claws have smaller teeth in R. cramboides than they do in R. conica. The pupa resembles that of R. cramboides.

Description

Male. Wing length, 2.4-2.7 mm. Eyes contiguous at vertex. Antenna with 14-15 flagellomeres; neck flagellomere III, 0.72-0.81 length node; necks V and VII, 0.68-0.81 length node. Fused labella hemispherical in frontal view, with

3.13 setae per labellum. Palpus 1-segmented, ovoid, with 3-10 setae. Frontoclypeus with 5-8 setae per side. Anepisternal setae 5-16. Claws toothed, the teeth strong, occasionally bifid. Abdomen: tergum III with 10-20 setae per side, V with 15-21, VII with 13-20, and VIII with 19-26 setae and several scales, the setal groups of tergum VIII contiguous mesally; pleura I-V with 0-5 setae; VI with 4-8, VII with 9-14, and VIII with 15-21 setae and no scales; sterna II-VII with basal pair of trichoid sensilla, sternum VII with 21-30 setae in caudal groups and 19-31 in basal. Genitalia: basimere with small mesobasal lobe, otherwise tapering gradually from base to narrower apex; telomere ovoid, tooth wide; caudal margin sternum X straight to concave.

Female. Wing length, 1.4-1.8 mm. Antenna with 13-15 flagellomeres; neck flagellomere III, 0.21-0.32 length node, necks V and VII, 0.11-0.24 length node, necks indistinct beyond VIII-IX. Other head and thoracic characters as in male. Abdomen: tergum III with 9-16 setae per side, V with 11-22, and VII with 11-15; pleura I-V without setae, VI with 0-2, and VII with 5-10 setae and no scales; sterna II-VII with basal pair of trichoid sensilla; sternum VII with 21-30 setae in caudal groups, 18-22 in basal, this group divided into three distinct subgroups; tergum VII 0.30-0.33 length distal half ovipositor.

Pupa. (Figs. 61-62). Antennal horns short, the posteroventral corner weakly produced. Fronts with short ridge immediately caudal of each antennal horn and with or without short pair of frontal projections lateral of clypeal base.

Holotype, male, 5 mi E Twin Falls, Twin Falls Co, Idaho, V-14-1968, Artemisia tridentata, R. G. Jones, USNM Type No. 66638.

Biology

Seasonal occurrence. Immature larvae were found in late March 1970 at Site 23 coinciding with the first sign of developing galls. A collection of mature larvae was made at this site on May 6, 1969. Pupae were collected from galls on A. t. wyomingensis at Site 21 on April 21, 1969 and from A. t. tridentata at Site 1 on April 23, 1969. In the field, adult emergence coincided with that of R. pomum at Sites 1 and 2. Adults emerged from April 20-24, 1969 from galls collected April 14 at Site 15. From another collection of galls made on May 14, 1969 from A. t. tridentata at Site 1, adults emerged on May 15-16.

Gall

Description and development. This bud gall is monothalamous. The mature gall is green and covered with trichomes. The larval capsule has a yellowish translucent sclerenchymatous surface. On A. t. tridentata the prominent sclerenchymatous larval capsule of the mature gall (Fig. 30) is surrounded by a whorl of basally fused leaf vestiges around which are several whorls of linear or spatulate leaves that gradually increase in length outwardly. The gall is irregularly rosette in form. On both A. t. vaseyana "f. xericensis" and A. t. wyomingensis the mature gall (Fig. 31) is more normally rosette. The sclerenchymatous larval capsule is surrounded by several whorls of equally long, ovate leaves.

Thirty-one mature galls collected at Site 1 and 2 on A. t. tridentata had a diameter (measured at base including inner whorl of leaves) ranging from 3-6 mm (avg. 4). The sclerenchymatous capsules of these galls had a length range of 3-4 mm (avg. 3.2) and the width or diameter of each was approximately 1 mm. The diameter (measured across the apices of the outer leaves) of 26 mature galls collected at Sites 15 and 21 from A. t. wyomingensis ranged from 8-21 mm (avg. 9.41). The capsule measurements were the same as those from A.

t. wyomingensis, of 17 mature galls from A. t. vaseyana "f. xericensis" ranged from 10-16 mm (avg. 13). The capsule lengths ranged from 3-5 mm with diameters of approximately 1 mm.

Developing galls occur with the initiation of spring plant growth. On A. t. wyomingensis the developing gall was first found seasonally on March 23, 1970 at Site 12 and on A. t. vaseyana "f. xericensis" the following day at Site 27. The galls dry shortly after midge emergence the following spring and persist on the plant into at least late summer. Galls from which emergence has occurred are readily recognized by the protruding larval capsule that is broken apically.

Effect on the plant. Normal stem growth at the bud was prevented by the formation of this gall, but the overall effect on plants was minimal since galls were not concentrated but generally distributed over the plant.

Associated insects

Platygasteridae. Platygaster utahensis and Platygaster sp. were found to parasitize this midge species.

Chalcidoidea. Tetrastichus sp. was reared from the larval capsules of these galls.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bear Lake Co: 9 mi S Dingle, 6300 ft; 12.4 mi E Montpelier, 6350 ft; Blaine Co: 3 mi W Carey, 5150 ft; Cassia Co: 8 mi SE Albion, 5350 ft; 4 mi W Almo, 6200 ft; Franklin Co: 1.5 mi W Dayton, 4750 ft; Lincoln Co: 25 mi N Shoshone, 4960 ft; 5 mi NE Shoshone, 4000 ft; Twin Falls Co: 18 mi E Rogerson, 5700 ft; NEVADA: Pershing Co: 4 mi N Mill City.

A. tridentata tridentata: IDAHO: Canyon Co: 15 mi S Nampa, 2350 ft; Elmore Co: Hot Springs, 9 mi NE Mt. Home (pupa, paratypes); Gooding Co: 5.5 mi E Gooding, 3800 ft (4 females, 5 pupae, paratypes); 5 mi N Hagerman (2 females, 2 pupae, paratypes); Lemhi Co: 16 mi N Salmon, 4000 ft; Lincoln Co: 11.5 mi W Kimama, 4275 ft; 10.5 mi NE Richfield, 4700 ft; Owhyhee Co: 4 mi NW Murphy, 2800 ft; Twin Falls Co: 11 mi S Hansen, 4300 ft; 5 mi E Twin Falls, 3746 ft (holotype male, female, pupal exuvia, paratypes); 5.5 mi E Twin Falls, 3650 ft; 6 mi NE Twin Falls, 3700 ft; WASHINGTON: Franklin Co: Palouse Falls State Park (2 males, paratypes).

A. tridentata vaseyana: IDAHO: Valley Co: 6 mi N Cascade, 4700 ft.

A. tridentata vaseyana "f. xericensis": IDAHO: Washington Co: 8 mi N Weiser, 2580 ft.

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (male, 4 females, pupa, pupal exuvia, paratypes) (specimens reared); Gooding Co: 9 mi W Bliss, 3000 ft (3 females, paratypes).

A. arbuscula: IDAHO: Bear Lake Co: 12.4 mi E Montpelier, 6350 ft.

A. nova: IDAHO: Cassia Co: 8 mi SE Albion, 5350 ft.

A. tripartita: IDAHO: Bear Lake Co: 3 mi N Georgetown, 6200 ft.

Rhopalomyia mammilla Gagné, new species (Figs. 32, 63, 64)

Diagnosis

Adults of R. mammilla have 1-segmented palpi, toothed claws and the males

have a large ventrobasal lobe on the basimere. This species is closely related to R. hirticaulis. Adults differ chiefly in shape of the telomere which, in R. mammilla, tapers gradually from the wide base to the long apical tooth; pupae differ only in the R. mammilla has slightly longer antennal horns.

Description

Male. Wing length, 2.1-2.2 mm. Eyes contiguous at vertex. Antenna with 14-15 flagellomeres; neck flagellomere III, 0.42-0.48 length node; necks V and VII, 0.53-0.58 length respective nodes. Fused labella ellipsoid, 2-7 setae per labellum. Paupus 1-segmented, elongate-ovoid, with 3-6 setae. Frontoclypeus with 1-6 setae. Anepisternum with 4-7 setae. Claws toothed. Abdomen: tergum III with 11-23 setae per side, V with 11-22, VII with 13-27, and VIII with 11-15 setae and no scales, the setal groups of VIII contiguous mesally; pleura I-V with 0-3 setae, VI with 3-7, VII with 7-10 and several scales, and VIII with 15-19 setae and scattered scales; sterna II-VII each with basal pair of trichoid sensilla; sternum VII with 29-34 setae in caudal group and 26-32 in basal. Genitalia: basimere with large basoventral lobe; telomere elongate-cylindrical, tapering gradually from base to narrow tooth; sternum X margin convex apically.

Female. Wing length, 1.4-1.7 mm. Antenna with 13-14 flagellomeres; necks indistinct. Other head and thoracic characters as in male. Abdomen: tergum III with 6-9 setae, V with 5-12, and VII with 11-13; pleura I-V naked, VI with 1-3 setae, and VII with 3-5; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 18-24 setae in caudal group, 12-17 in basal, the latter group divided into three subgroups; tergum VII approximately 0.38 length distal half ovipositor.

Pupa (Figs. 63-64). Antennal horn produced ventrally with an anteroventral projection and a small basal spur. Frons with pair of triangular projections at level of clypeal base. Pronotum long, greatly extended ventrally between antennal horns.

Holotype, male, 15 mi NW Blackfoot, Bingham Co., Idaho, IX-9-1968, Artemisia tridentata, R. G. Jones, USNM Type No. 66639.

Biology

Seasonal occurrence. Adults emerged September 10-17, 1968 from galls collected on September 9 at Site 14. On the collection date the host plants were in early bloom.

Gall

Description and development. This polythalamous rosette gall (Fig. 32) grows from a bud on the current year's stem and is subtended prior to maturity by two or more ephemeral leaves. It is composed of several whorls of mostly equal, linear to acicular leaves surrounding two to four sclerenchymatous larval capsules.

The basal diameter of one measured gall was 6 mm. Its outer leaves were up to 10 mm in length and the other leaves approximately 5 mm in length.

Associated insects

Platygasteridae. Platygaster sp. was reared from galls of this species.

Chalcidoidea. Torymus aeneoscapus represented the only species of this

superfamily reared from galls of R. mammilla.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bingham Co: 15 mi NW Blackfoot (holotype male and female, paratype).

A. tridentata tridentata: IDAHO: Cassia Co: 4 mi E Idahome, 4400 ft.; 8 mi SE Malta, 4400 ft; Twin Falls Co: 5 mi E Twin Falls, 3746 ft

A. tridentata vaseyana: IDAHO: Custer Co: 8 mi NW Mackay, 6200 ft (2 males, 6 females, 3 pupae, paratypes); Twin Falls Co: 17 mi S Hansen, 4725 ft; 22 mi S Hansen, 5700 ft.

A. tridentata wyomingensis: IDAHO: Lemhi Co: 1 mi NE Baker, 4500 ft.

Rhopalomyia obovata Gagné, new species (Figs. 33, 43, 44, 65, 66, 94, 95)

Diagnosis

This species is one of the largest and more robust of the Artemisia associated midges and, like most of the other large species, has 2-segmented palpi and toothed claws. The distinctive male genitalia and the pupal head with its pronounced conical antennal horns set R. obovata apart from all other Artemisia associated midges except R. nucula. This species differs from the latter in the absence of scales from most of the abdominal pleura, the wider male telomere tooth, and the relatively more pronounced pronotum and antennal and facial horns of the pupa. Also, larvae of R. obovata have three pairs of terminal papillae and those of R. nucula have only one pair.

Description

Male. Wing length, 3.3-3.5 mm. Eyes separated at vertex by 1-3 facets diameter. Antenna with 16-17 flagellomeres; neck flagellomere III, 0.54-0.56 times length node; neck V, 0.57-0.60 length node; neck VII, 0.57-0.73 length node. Fused labella hemispherical in frontal view, usually naked, occasionally with one seta per labellum. Palpus 2-segmented, the segments subequal in length; naked except for occasional seta on segment I. Frontoclypeus with 3-14 setae per side. Anepisternum with 9-15 setae. Claws strong, each with strong tooth, the latter occasionally bi- or trifid on one or more legs. Empodia approximately as long as claws. Abdomen: tergum III with 17-35 setae per side, V with 20-48, VII with 19-46, and VIII with 16-31, the two groups of setae on tergum VII contiguous mesally; pleura I-VI without setae or scales; VII with 0-4 setae, VIII with 0-7 setae; sterna II-VII each with basal pair of trichoid sensilla, sternum VII usually without sensilla occasionally with one, sternum VII with 32-44 setae in distal group, 22-39 in basal group, these continuous across width of sternum. Genitalia (Figs. 94-95): basimere short, stout, in lateral view much wider basally than apically, small mesoventral lobe inconspicuous in lateral view; telomere elongate cylindrical, tapering abruptly at wide apical tooth; sternum X slightly to deeply bilobed.

Female. Wing length, 2.5-2.6 mm. Eyes almost contiguous at vertex, separated by less than 1 facet diameter. Antenna with 15 flagellomeres; neck flagellomere III, 0.25-0.27 length node; neck V, 0.22-0.26 length node; neck VII, 0.17-0.24 length node; necks indistinct after flagellomere XI-XII. Other

head and thoracic characters as in male. Abdomen: tergum III with 21-28 setae per side, V with 17-24, and VII with 15-23, the two groups of tergum VII setae not contiguous mesally; pleura I-VI without setae or scales, VII with 0-2 setae; sterna II-VII each with basal pair of trichoid sensilla; sternum VII with 24-28 setae in distal group, 16-26 in basal group, these in a row reaching across width of sternum or interrupted mesally; tergum VII 0.37 - 0.40 length distal half of ovipositor.

Pupa. (Figs. 43-44, 65-66). Antennal horns long, conical, tapering gradually from base to pointed apex. Frons with two pairs of projections: a pair of transverse ridges immediately caudad of the antennal bases, the anterior surface concave, the posterior convex, and a well developed pair of pointed, bilaterally compressed projections laterad of the base of the clypeus.

Holotype, male, 5 mi. E. Twin Falls, Twin Falls Co., Idaho, III-24-1969, Artemisia tridentata tridentata, R. G. Jones, USNM Type No. 66640.

Biology

Seasonal occurrence. Immature larvae were found June 13, 1969 at Site 1 on both A. t. tridentata and A. t. wyomingensis, coinciding with the first sign of gall development. By late fall the larva reaches maturity. They are a darker orange color than larvae found earlier and they completely fill the sclerenchymatous capsule in the center of the gall. Overwintering occurs at this stage of development. The earliest collections of pupae were made at Site 1 on March 24, 1969 and the latest made May 18, 1968 on A. t. vaseyana at Site 8. At both sites spring ephemeral leaf development either had not started or was just discernable. Adults were emerging by March 24, 1969 at Site 1, whereas in 1970 they emerged before March 20 at this site and before March 19 at Site 24. Emergence was in progress as late as May 18, 1968 at Site 8.

Laboratory rearings indicate that adult emergence may occur over a considerable period of time in the field. Adults emerged January 10, 1970, from galls collected on December 29, 1969 from A. t. vaseyana "f. xericensis" at Site 27, March 24-26, 1969 from galls collected March 24 at Site 1, and May 19-23, 1968 from galls collected at Site 8 on May 18. Altitudinal differences of these sites may be responsible for some of this variation in time of emergence.

Gall

Description and development. This ovoid bud gall has vestiges of spatulate leaves (Fig. 33). Its smooth, green surface is densely covered with trichomes. Maturity is reached in the fall after which degeneration begins. The gall surface dries and hardens, becoming shiny yellow-brown and losing its trichomes and the leaf vestiges. By late fall the tissue beneath the surface layer dries to a hard black mass which surrounds the 1-4 sclerenchymatous larval capsules containing the overwintering larvae. These dry galls persist on either vegetative or flower stems into the following spring until shortly after the midges emerge.

Seventy-eight mature galls from the three subspecies of A. tridentata collected at Sites 1, 15, 21 and 27 ranged in diameter from 5-10 mm (avg. 7) and in height from 6-11 mm (avg. 8). No size differences of the galls could be attributed to host plant or location. Ten immature galls collected from A. t. tridentata at Site 1 on June 13, 1969 had a diameter ranging from 204 mm (avg. 3).

The developing gall wick first appears as swellings of the bud and leaf

base on developing stems differ from the mature gall only in size. When these galls were first evident the ephemeral leaves were near maturity, the new persistent leaves were developing, the old persistent leaves were mostly dry, and flower stems were distinguishable.

Effect on the plant. With gall formation normal growth ceases in the affected bud. Some branch mortality occurs with concentration of galls, but no major damage was observed.

Associated insects

Platygasteridae. Platygaster sp. was reared from these galls and found to parasitize this midge.

Chalcidoidea. The following were reared from galls and found to parasitize this midge: Torymus aeneoscapus, Tetrastichus sp., a species of Pteromalinae and a species of Eupelmidae.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bannock Co: .5 mi W McCammon, 4719 ft; Bear Lake Co: 12.4 mi E Montpelier, 6350 ft; Bingham Co: 15 mi NW Blackfoot; Boise Co: 7 mi S Horseshoe Bend, 4200 ft; 20 mi S Idaho City; Cassia Co: 8 mi SE Albion, 5350 ft; 6 mi W Burley, 4240 ft; Clark Co: 4 mi NE Argora, 7250 ft; 3.5 mi W Dubois, 5150 ft; Custer Co: 4 mi SW Clayton, 5000 ft; Elmore Co: 9 mi W Bliss, 3000 ft; 7 mi S Mt. Home, 3000 ft; Owyhee Co: 27 mi S Bruneau, 4650 ft; 40 mi SE Bruneau; 28 mi SW Marsing; 5 mi E Murphy, 2900 ft; 6 mi E Murphy, 2900 ft; 3 mi E Reynolds; Power Co: 14 mi W American Falls, 4400 ft; NEVADA: Pershing Co: 4 mi N Mill City; Washoe Co: 16 mi SE Reno.

A. tridentata tridentata: IDAHO: Cassia Co: 4 mi E Idahome, 4400 ft; 6 mi NE Malta, 4400 ft; 8 mi SE Malta, 4400 ft; Gooding Co: 5.5 mi E Gooding, 3800 ft; Lemhi Co: 16 m N Salmon, 4000 ft; Lincoln Co: 11.5 mi W Kimama, 4275 ft; Minidoka Co: 2 mi E Acequia, 4200 ft; Owyhee Co: 2 mi W Indian Cove, 2850 ft; 23 mi SW Grandview; Twin Falls Co: 6 mi S Bliss; 11 mi SW Bliss; 5 mi E Twin Falls, 3746 ft (holotype male, 4 males, 3 females, and 2 pupae, paratypes); WASHINGTON: Franklin Co: Palouse Falls State Park.

A. tridentata vaseyana: IDAHO: Blaine Co: 2 mi W Carey (2 pupae, paratypes); Galena Summit viewpoint, 8600 ft (3 males, 7 females, 42 pupae, paratypes); Camas Co: 12 mi S Fairfield, 5450 ft; Custer Co: 8 mi NW Mackay, 6200 ft; 32 mi NW Mackay, 6425 ft; Pass Creek Summit, 7633 ft; Elmore Co: Little Camas Res. (female, paratype); Gooding Co: 16 mi N Gooding, 5225 ft; Lemhi Co: Bannock Pass Summit, 7672 ft; 10 mi E Leadore; Oneida Co: 9.5 mi W Malad, 5200 ft; Twin Falls Co: 17 mi E Rogerson, 5700 ft; Valley Co: 6 mi N Cascade, 4700 ft; Washington Co: 4 mi S Midvale, 3200 ft.

A. tridentata vaseyana "f. xericensis": IDAHO: Washington Co: 8 mi N Weiser, 2850 ft.

A. tridentata wyomingensis: IDAHO: Canyon Co: 15 mi S Nampa, 2500 ft; Elmore Co: 3 mi N Mt. Home, 3325 ft (specimens reared); Gooding Co: 12 mi N Gooding, 4400 ft; 3 mi S Hagerman, 2964 ft; Lemhi Co: 1 mi NE Baker, 4500 ft; Lincoln Co: 12 mi W. Kimama, 4275 ft; Owyhee Co: 5 mi N. Reynolds, Twin Falls Co: 8 mi N Roseworth, 4800 ft; 4 mi E Twin Falls, 3746 ft (specimens reared).

A. arbuscula: IDAHO: Bear Lake Co: 12.4 mi E. Montpelier, 6350 ft; Clark Co: 18 mi NW Terreton, 4800 ft.

A. nova: IDAHO: Butte Co: 19.9 mi NE Howe, 5100 ft; Cassia Co: 8 mi SE Albion, 5350 ft; 3 mi NW Malta, 4400 ft.

A. tripartita: IDAHO: Bannock Co: .5 W McCammon, 4719 ft.

Rhopalomyia nucula Gagné, new species
(Figs. 34, 35)

Diagnosis

This species is close to R. obovata. The pupae of both species are very similar, but adults may be separated by the abdominal setation and shape of the male telomere. The tooth of the latter is narrower in R. nucula than in R. obovata. As evident from their descriptions the galls of these two species are very different.

Description

Male Wing length, 2.6-3.1 mm. Eyes separated at vertex by 1.0-1.5 facets diameter. Antenna with 15-16 flagellomeres; neck flagellomere III, 0.45-0.55 length node; neck V, 0.45-0.51 length node; and neck VII 0.50-0.55 length node. Fused labella hemispherical in frontal view, occasionally indented mesally, 0-1 setae per labellum. Palpus 2-segmented, segment II generally longer, usually about twice length I, 1-4 setae per segment. Frontoclypeus with 3-8 setae per side. Anepisternum with 14-29 setae. Claws strong toothed, the latter occasionally bi- or trifid on one or more legs. Empodia approximately as long as claws. Abdomen: tergum III with 12-17 setae per side, V with 10-17; VII with 12-19, and VIII with 7-13, the two lateral groups not contiguous mesally; pleura with a few setae on segment VIII only, but all segments covered with scales; sterna II-VII each with a basal pair of trichoid sensilla; sternum VII with 19-34 setae in caudal group, 30-55 in basal group, the latter undivided mesally. Genitalia; basimere short, stout, in lateral view much wider basally than apically, small mesoventral lobe inconspicuous in later view; telomere elongate-cylindrical, tapering abruptly at apical tooth, the latter approximately 0.5 width telomere at widest; sternum X slightly to deeply bilobed apically.

Female. Wing length, 2.1-2.4 mm. Antenna with 14-15 flagellomeres; neck flagellomere III, 0.30-0.32 length node; neck V, 0.29 length node; neck VII, 0.03-0.22 length node; necks indistinct beyond flagellomere VIII. Other head and thoracic characters as in male. Abdomen: tergum III with 11-22 setae per side, V with 10-19, and VII with 9-15 the lateral groups of tergum VII not contiguous mesally; pleura without setae, but scales numerous on all segments; sterna II-VII each with two basal trichoid sensilla; sternum VII with 16-30 caudal setae and 14-22 basal setae, these divided mesally into two lateral groups; tergum VII 0.36-0.39 length distal half of ovipositor.

Pupa. Antennal horns long, conical, tapering gradually from base to pointed apex. Frons with a pair of low, convex bumps immediately caudad of antennal bases, and a pair of pointed, bilaterally compressed projections laterad of base of the clypeus.

Holotype, male, 5 mi E Twin Falls, Twin Falls Co., Idaho, III-20-1970, Artemisia tridentata, R. G. Jones, USNM Type No. 66641.

Biology

Seasonal occurrence. Immature larvae were found on A. t. wyomingensis June 10, 1968 at Site 15, coinciding with the first sign of gall development. Larvae also were collected on both A. t. tridentata and A. t. wyomingensis June 13, 1969 at Site 1. Larvae were found through the summer and fall and into the following spring. Mature larvae were present on April 17, 1969 on A. t. tridentata at Site 23. Pupae were collected April 17, 1969 at Site 23 and

in 1970 on March 20 at Sites 1 and 3. At the time of these collections the first whorls of ephemeral leaves had begun spring growth. Field observation showed that adults had emerged by March 20, 1970 at Site 1 and prior to March 23, 1970 at Site 21. Adults emerged on April 12, 1969 from galls collected on March 24 at Site 1, and the following year they emerged on March 29 and 31, 1970 from galls collected on March 20 at Site 4 and on April 19, from galls collected April 17 at Site 23.

Gall

Description and development. The white or gray polythalamous gall (Fig. 34) appears to be a concentration of individual, ovoid galls (Fig. 35) that form a globuliferous mass around a stem. The gall is a firm mass of plant tissue with centrally located larval chambers. The surface is densely clothed with long trichomes giving it a fuzzy appearance.

Sixty-three mature galls collected from A. t. tridentata and A. t. wyomingensis at Sites 1, 21 and 24 ranged in width (diameter perpendicular to stem) from 30-15 mm (avg. 9) and in height (diameter parallel to stem) from 3-10 mm (avg. 6). These galls had 1-11 (avg. 5) larval chambers.

Galls develop from summer to the following spring with most noticeable growth occurring before winter. The first sign of the developing gall was in early June when immature larvae were found. At this time ephemeral leaves were near full growth, the persistent leaves were nearly dry, and the gall appeared as a small white globose structure at a node. Ten of these developing galls collected on June 18, 1969 at Site 1 ranged in width from 1.5 to 2.5 mm (avg. 1.9). Galls begin to dry and decompose after midge emergence. However, old gray colored galls were observed persisting on plants for at least a year.

Effect on the plant. No extensive damage was observed, but some minor twig or stem mortality occurred with the formation of the gall.

Associated insects

Tephritidae. Oxyna palpalis was reared from galls collected at several sites on A. t. tridentata and A. t. wyomingensis.

Chalcidoidea. Several species were reared from these galls, including Torymus aeneoscapus, Tetrastichus sp., a species of Pteromalinae and a species of Eupelmidae.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Boise Co: 7 mi S Horseshoe Bend, 4200 ft; Butte Co: 21 mi SW Arco, 6000 ft; Cassia Co: 4 mi W Almo, 6200 ft; Elmore Co: 7 mi S Mt. Home, 3000 ft, (9 females, paratypes); Gooding Co: 9 mi W Bliss, 3000 ft; Lemhi Co: 3 mi NE Baker, Owyhee Co: 27 mi S Bruneau, 4650 ft; 40 mi SE Bruneau; Twin Falls Co: 18 mi E Rogerson, 5700 ft; 5 mi E Twin Falls, 3746 ft (holotype male, 3 males, 7 females, 4 pupae, paratypes). NEVADA: Pershing Co: 4 mi N Mill City; Washoe Co: 16 mi SE Reno, 12 mi SW Reno.

A. tridentata tridentata: IDAHO: Butte Co: .5 mi W Arco, 5300 ft; Cassia Co: 4 mi E Idahome, 4400 ft; Lincoln Co: 11.5 mi W Kimama, 4275 ft (9 males, 6 females, 9 pupae, paratypes); Minidoka Co: 2 mi E Acequia, 4200 ft (3 males, 5 females, 4 pupae, paratypes); Owyhee Co: 23 mi SW Grandview; Twin Falls Co: 11 mi SW Bliss; 23 mi SW Twin Falls, 4950 ft (specimens reared); MONTANA: Beaverhead Co: 12 mi E Bannock Pass Summit; 17 mi E Bannock Pass Summit; WASHINGTON: Garfield Co: 14 mi W Clarkston.

A. tridentata vaseyana: IDAHO: Blaine Co: Galena Summit viewpoint, 8600 ft (specimens reared); 15 mi NW Ketchum 7500 ft; 6 mi S Ketchum, 55 ft; Camas Co: 12 mi S Fairfield, 5450 ft; Cassia Co: City of Rocks (5 males, female, 6 pupae, paratypes); Elba-Basin Pass Summit; 7 mi E Oakley; Custer Co: Willow Creek Divide, 7160 ft; Owyhee Co: 2 mi N Riddle, 5400 ft; 7 mi E Sheaville, Oregon; Twin Falls Co: 17 mi S Hansen, 4725 ft (5 females, pupa, paratypes); 21 mi S Hansen, 5240 ft; 22 mi S Hansen, 5700 ft; Magic Mt. Ski Area, 6400 ft (2 males, 3 pupae, paratypes) (specimens reared); 21 mi E Rogerson, 7250 ft.

A. tridentata vaseyana "f. xericensis": IDAHO: Washington Co: 8 mi N Weiser, 2580 ft.

A. tridentata wyomingensis: IDAHO: Elmore Co: 3 mi N Mt. Home, 3325 ft (specimen reared); Gooding Co: 3 mi S Hagerman, 2964 ft; Twin Falls Co: 8 mi N Roseworth, 4800 ft.

A. nova: IDAHO: Cassia Co: 3 mi NW Malta, 4400 ft.

Rhopalomyia medusa Gagné, new species
(Figs. 36, 37, 38, 39, 67, 68)

Diagnosis

Rhopalomyia medusa and R. medusirrasa are anatomically indistinguishable as adults, larvae and pupae. However, their galls are sufficiently different to warrant recognition of these species. Although the galls are the same general type, that of R. medusa is naked, whereas that of R. medusirrasa is thickly covered with long tyrichomes.

These species are similar to R. pomum and R. calvipomum in their large size, 2-segmented palpi, toothed claws, and the general shape of the genitalia and pupal heads. The most reliable characters for separating R. medusa from R. pomum and R. calvipomum are the number of trichoid sensilla on the abdominal sterna and the presence or absence of basimeral lobes on the male genitalia.

Description

Male. Wing length, 2.4-3.0 mm. Eyes almost contiguous at vertex, less than 1 facet diameter apart. Antenna with 15-16 flagellomeres; neck flagellomere III, 0.57-0.71 length node; neck V, 0.61-0.76 length node; neck VII 0.63-0.70 length node. Fused labella hemispherical in frontal view; 0-12 setae per labellum. Palpus usually 2-segmented, segment II, if present, 0.5-1.0 length I, either segment with 0-4 scattered setae. Frontoclypeus with 4-14 setae per site. Anepisternum with 11-18 setae. Claws toothed, the tooth occasionally bifid. Empodia approximately as long as claws. Abdomen: tergum III with 18-30 setae per side, V with 16-34, VII with 22-39, and VIII with 17-40, lateral groups of tergum VIII contiguous mesally; pleura I-VI without setae, VII with 0-3, and VIII with 3-10 setae and no scales; sterna II-VII each with two basal trichoid sensilla, sternum VII with 33-42 setae in distal group, 28-48 in basal, the latter continuous across sternum. Genitalia: basimere in lateral view with indistinct lobe tapering gradually from wide base to narrower apex; telomere ovoid with wide tooth; sternum X truncate to bilobed.

Female. Wing length, 1.8-2.3 mm. Antenna with 13-15 flagellomeres; neck flagellomere III 0.10-0.18 length node; neck V, 0.06-0.18 length node; neck VII, 0.06-0.16 length node; necks indistinct beyond flagellomeres VIII-X. Other head and thoracic characters as in male. Abdomen: tergum III with 11-22

setae per side, V with 11-23, and VII with 14-20, lateral groups of VII contiguous mesally; pleura without setae but with scattered scales on distal segments; sterna II-VII each with basal pair of trichoid sensilla, sternum VII 24-40 setae in distal group, 13-33 in basal, the latter occasionally divided mesally; tergum VI 0.32-0.35 length distal half ovipositor.

Pupa (Figs. 67-68). Antennal horns short, weakly bifid apically with short ventrobasal spur. Frons with pair of angular bilaterally compressed projections.

Holotype, male, 8 mi NW Mackay, Custer Co, Idaho, V-17-1968, Artemisia tridentata vaseyana, R. G. Jones, USNM Type No. 66642.

Biology

Seasonal occurrence. Immature larvae were found from early September to early October coinciding with the first sign of gall development. Apparently mature larvae were found on May 15-16, 1969 on A. t. vaseyana at Site 6 and on June 15, 1968 on A. t. vaseyana f. spiciformis at Site 17.

Adult emergence occurred prior to April 21, 1969 at Site 21 from A. t. wyomingensis and was still in progress on May 6, 1969 0.5 mi from Site 23. At Site 17 emergence from A. t. vaseyana f. spiciformis occurred between June 15 and July 11, 1968. At Site 27 adults emerged April 15-19, 1969 from A. t. vaseyana "f. xericensis" from galls collected on April 8. Emergence occurred from A. t. wyomingensis on April 18-19, 1969 from galls collected with pupae present on April 14 at Site 21 and from A. t. tridentata on May 10 from galls collected with pupae present on May 6, 1969 at Site 24. The latest emergence was June 18, 1968 from galls collected on June 16 from A. tripartita at Site 26 while the earliest was March 28, 1970 from galls collected on March 20 from A. t. wyomingensis growing at Site 1.

Gall

Description and development. The mature gall (Fig. 36) consists of a larval chamber (Fig. 37) enclosing in a globular mass of reddish, green, or reddish and green filaments that lack trichomes. The filaments are thickened basally and become thinner, curly and branched distally. Frequently, galls form on several adjacent stem and leaf nodes and encompass large areas of the stem (Fig. 38).

One hundred mature galls from A. t. tridentata, A. t. vaseyana and A. t. wyomingensis collected at Sites 1, 7, 21 and 24 had a diameter (the fibrous mass measured perpendicular to stem) ranging from 8-29 mm (avg. 13.3). Seventy-five of these galls contained 1-3 larval chambers (avg. 1.2). Larger galls were usually observed on more vigorous roadside plants on A. t. tridentata.

The first sign of galls was during early September 1968 on both A. t. tridentata and A. t. wyomingensis. The developing galls were observed on the other host subspecies later in the fall. The galls first appear as groups of tiny leaflike structures growing from the nodes (Fig. 39). Gall development continues during the fall, is arrested during the winter, and continues in the spring with maximum size of the galls reached about the time pupae are present. Stem growth was approximately 2.5-5.0 cm in length by this time at most sites. Within a month after adult emergence the galls become dry and brown. They persist on the host plants for 2-12 months or longer. Developing galls were often found on flower stems but did not reach maturity because these stems died out following bloom in the fall.

Effect on the plant. No stem mortality was found but the presence of many galls appeared to have some effect on the vigor of stem and leaves.

Associated insects

Platygasteridae. Specimens of Platygaster spp. were reared from the galls.
Chalcidoidae. Tetrastichus sp. and an undetermined species of Peteromalinae were reared from the galls.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Bannock Co: .5 mi W McCammon, 4719 ft; Bear Lake Co: 9 mi S Dingle, 6300 ft; 12.4 mi E Montpelier, 6350 ft; Bingham Co: 5 mi NE Taber; Blaine Co: 3 mi W Carey, 5150 ft; Boise Co: 7 mi S Horseshoe Bend, 4200 ft; 20 mi S Idaho City; Butte Co: 21 mi SW Arco, 6000 ft; Cassia Co: 8 mi SE Albion, 5350 ft (specimens reared); Clark Co: 3.5 mi W Dubois, 5150 ft (male, 6 females, pupa, paratypes); 8 mi N Small, 5960 ft; Custer Co: 5 mi E Clayton, 5650 ft; 4 mi SW Clayton, 5000 ft; Franklin Co: 1.5 mi W Dayton, 4750 ft; Lemhi Co: 3 mi NE Baker; Lincoln Co: 4 mi N Dietrich, 4100 ft; 25 mi N Shoshone, 4960 ft; 5 mi NE Shoshone, 4001 ft; Madison Co: 9 mi W Rexburg, 4850 ft; Owyhee Co: 27 mi S Bruneau, 4650 ft (specimens reared); 40 mi SE Bruneau; 28 mi SE Marsing; 3 mi E Reynolds; 14 mi S Riddle, 5300 ft; Power Co: 14 mi W American Falls, 4400 ft; Twin Falls Co: 11 mi NW Buhl; 18 mi E Rogerson, 5700 ft (male, paratype); 8 mi SW Rogerson, 6200 ft; Teton Co: 3 mi S Driggs, 6150 ft; NEVADA: Pershing Co: 4 mi N Mill City.

A. tridentata tridentata: IDAHO: Gooding Co: 6 mi SE Bliss, 3140 ft (2 males, pupa, paratypes); Lemhi Co: 3.5 mi E Leadore, 5850 ft; Lincoln Co: 11.5 mi W Kimama, 4275 ft (pupa paratype); 10.5 mi NE Richfield, 4700 ft (2 males, 5 females, 12 pupae paratypes); Minidoka Co: 2 mi E Acequia, 4200 ft (male, female, 2 pupae paratypes); Owyhee Co: 2 mi S Riddle, 5300 ft; 23 mi SW Grandview (specimens reared); Twin Falls Co: 11 mi SW Bliss; 5 mi E Twin Falls, 3746 ft (specimens reared); MONTANA: Beaverhead Co: 6 mi E Bannock Pass Summit; 12 mi E Bannock Pass Summit (specimens reared); 17 mi E Bannock Pass Summit (specimens reared).

A. tridentata vaseyana: IDAHO: Blaine Co: Galena Summit viewpoint, 8600 ft (specimens reared); 15 mi NW Ketchum, 7500 ft; 6 mi S Ketchum, 5500 ft (specimens reared); Camas Co: 5 mi N Fairfield, 5150 ft; 9 mi N Fairfield, 6000 ft; 12 mi S Fairfield, 5450 ft; Cassia Co: Elba-Basin Pass Summit; 7 mi E Oakley; Custer Co: 5 mi NW Galena Summit, 7350 ft; 8 mi NW Mackay, 6200 ft (holotype male, 5 males, 2 females, pupa paratypes); 32 mi NW Mackay, 6425 ft; 10 mi S Stanley, 6550 ft; Willow Creek Divide, 7160 ft; Franklin Co: 3 mi W Dayton, 4800 ft (specimens reared); Gooding Co: 16 mi N Gooding, 5225 ft; Lemhi Co: 10 mi E Leadore; Twin Falls Co: 15 mi S Hansen, 4525 ft; 22 mi S Hansen, 5700 ft (specimens reared); 1 mi NW Magic Mt. Ski Area, 6600 ft; 17 mi E Rogerson, 5700 ft; 12 mi E Rogerson, 7250 ft; Washington Co: 4 mi S Midvale, 3200 ft; MONTANA: Beaverhead Co: 1.7 mi E. Bannock Pass Summit.

A. tridentata vaseyana f. spiciformis: IDAHO: Camas Co: 13 mi N Fairfield, 7000 ft; Franklin Co: 28 mi NE Preston, 6850 ft.

A. tridentata vaseyana "f. xericensis": IDAHO: Washington County: 8 mi N Weiser, 2580 ft (3 males, 7 females paratypes)

A. tridentata wyomingensis: IDAHO: Canyon Co: 15 mi S Nampa, 2500 ft; Elmore Co: 3 mi N Mt. Home, 3325 ft; Gooding Co: 3 mi S Hagerman, 2964 ft; 9 mi W Bliss, 3000 ft (male paratype); 12 mi N Gooding, 4400 ft; Lemhi Co: 1 mi NE Baker, 4500 ft; Lincoln Co: 12 mi W Kimama, 4275 ft; Owyhee Co: .5 mi S Grasmere, 5125 ft; 5 mi N Reynolds; Twin Falls Co: 8 mi N Roseworth, 4800 ft; 4 mi E Twin Falls, 3746 ft (3 males, 6 females, 3 pupae paratypes).

Specimens reared from the species below are indistinguishable from those on A. tridentata.

A. arbuscula: IDAHO: Bear Lake Co: 12.4 mi E Montpelier, 6350 ft; Owyhee Co: 14 mi S Riddle, 5300 ft; Twin Falls Co: 8 mi SW Rogerson, 6200 ft.

A. nova: IDAHO: Butte Co: 10 mi E Howe, 5150 ft; 19.9 mi NE Howe, 5100 ft; Cassia Co: 8 mi SE Albion, 5350 ft (specimens reared); 3 mi NW Malta, 4400 ft.

A. cana cana: IDAHO: Custer Co: 10 mi S Stanley, 6550 ft.

A. tripartita: IDAHO: Bannock Co: .5 mi W McCammon, 4719 ft; Lincoln Co: 10.5 mi NE Richfield, 4700 ft; Teton Co: 4.5 mi W Tetonia, 6025 ft (specimen reared).

Rhopalomyia medusirrasa Gagné, new species
(Figs. 40, 90, 91)

Diagnosis

Adults, larvae and pupae of this species are anatomically indistinguishable from R. medusa. Both form the same type of gall but that of R. medusirrasa is densely covered with long trichomes, whereas that of R. medusa is naked.

Adults of R. medusirrasa are separated from the related R. pomum and R. calvipomum on the basis of the trichoid sensilla on the abdominal sterna and the presence or absence of basimeral lobes on the male genitalia.

Description

External anatomy as for R. medusa. Male genitalia (Figs. 90-91). Pupal head as in Figs. 67-68.

Holotype, male, 22.5 mi S Hansen, Twin Falls Co., Idaho, V-16-1969, Artemisia tridentata vaseyana, R. G. Jones, USNM Type No. 66643.

Biology

Seasonal occurrence. Immature larvae were found during early October 1968 at Sites 5 and 25, coinciding with the first sign of gall development. The only collection made of mature larvae was on May 16, 1969 at Site 6. Adults had emerged prior to May 21, 1969 at Site 4. Under laboratory conditions, adults emerged April 25, 1969 from galls collected on April 22 at Site 13 and on May 19, 1969 from galls collected on May 16 at Site 6 when pupae were present.

Gall

Description and development. This gall (Fig. 40) resembles that of R. medusa but differs in that all radiating filaments are densely clothed with long trichomes. These trichomes generally mask the reddish and green colors of the filaments and give the gall a white or gray appearance.

Twenty-four mature galls from Sites 6 and 25 had a diameter (measured perpendicular to stem) ranging from 12-25 mm (avg. 17). Thirty-one galls that were collected April 14, 1969 at Site 6 prior to ephemeral leaf development had a diameter ranging from 6-16 mm (avg. 10) and contained 1-4 larvae (avg. 2).

The first sign of gall development was in early October with the appearance of small clumps of leaflike structures covered with trichomes at the nodes. The galls grow during the fall and again in the spring until about

the time pupae are present. At that time ephemeral leaves were just separating in the bud and no new stem growth had occurred. After adult emergence the galls dried but retained their gray appearance and persisted on the plants as for those of R. medusa.

Associated insects

Platygasteridae. Platygaster sp. was found to parasitize the midge.

Chalcidoidea. Torymus aeneoscapus and a species of Pteromalinae emerged from the galls concurrent or within a week of midge emergence in rearing containers.

Host plants and distribution of specimens studied

Artemisia tridentata: IDAHO: Owyhee Co: 6 mi S Grasmere, 5450 ft; Twin Falls Co: 8 mi SW Rogerson, 6200 ft; NEVADA: Washoe Co: 12 mi SW Reno.

A. tridentata vaseyana: IDAHO: Cassia Co: 4 mi W Almo, 6200 ft (2 males, 4 females, 3 pupae, paratypes); 8 mi W Elba, 6350 ft; Oneida Co: 9.5 mi W Malad, 5200 ft; 7 mi E Sheaville, Oregon; Twin Falls Co: 11 mi S Hansen, 4300 ft; 15 mi S Hansen, 4525 ft; 17 mi S Hansen, 4725 ft; 21 mi S Hansen, 5240 ft; 7 males 5 females, 3 pupae, paratypes); 22 mi S Hansen, 5700 ft (holotype male, 5 males, 6 females, 13 pupae, paratypes); 1 mi NW Magic Mt. Ski Area, 6600 ft.

A. tridentata wyomingensis: Twin Falls Co: Lower Rock Creek Canyon (male, female, pupal exuvium, paratypes).

Rhopalomyia hirticaulis Gagné, new species (Figs. 41, 69, 70, 92, 93)

Diagnosis

This species and R. tumidicaulis are the only ones responsible for stem galls on A. tridentata. Adults and pupae of both species are generally similar, but those of R. hirticaulis are distinguishable by the 1-segmented palip, more setose mouthparts, and ventrally produced pupal pronotum.

Description

Male. Wing length, 2.1-2.3 mm. Eyes contiguous at vertex. Antenna with 14-15 flagellomeres; neck flagellomere III, 0.47-0.57 length node; neck V, 0.50-0.61 length node; neck VII, 0.57-0.64 length node. Fused labella ellipsoid in frontal view, 6-8 setae per labellum. Palpus 1-segmented, elongate-ovoid, with 6-14 setae, these concentrated on apical half. Frontoclypeus with 5-9 setae per side. Anepisternum with 7-18 setae. Claws strong, toothed. Abdomen: tergum III with 12-18 setae per side, V with 14-21, VII with 16-20, and VIII with 23-29, the two last terga each with several scales and their setae contiguous mesally; pleura with several setae on each of segments IV-VIII, segments VII and VIII with scattered scales also; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 21-27 setae in distal group, 24-29 in basal, these continuous across width of sternum. Genitalia (Figs. 92-93): basimere with conspicuous ventral lobe; telomere ovoid, tooth wide, sternum X truncate apically.

Female. Wing length, 1.5-1.7 mm. Antenna with 13-14 flagellomeres; necks flagellomeres III and V, 0.05 length respective nodes; necks indistinct beyond flagellomere V. Other head and thoracic characters as in male. Abdomen: tergum III with 7-9 setae per side, V with 9-11, and VII with 9-13, lateral groups of VII contiguous mesally; pleura I-V naked, VI with 2-3 setae, and VII with 5-6 setae, 0 scales; sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 19-20 setae in distal group, 8-17 in basal, these separated mesally; tergum VII approximately 0.40 length distal half of ovipositor.

Pupa (Figs. 69-70). Antennal horn produced ventrally with an anteroventral projection and a small basal spur. Frons with pair of angular, bilaterally compressed projections. Pronotum long, greatly extended ventrally between antennal horns.

Holotype, male, 11.5 mi W Kimama, Lincoln Co, Idaho, VIII-16-1969, Artemisia tridentata tridentata, R. G. Jones, USNM Type No. 66644.

Seasonal occurrence. Immature larvae were found June 5, 1969 at Site 24, coinciding with first sign of gall development. Adults emerged in the field on July 23, 1969 at Site 23, and at Site 244 sometime prior to August 8, 1969. Adults emerged July 26-27 from galls collected at Site 23 on July 23, 1968. The following year, adults emerged from July 21-31 from galls collected on July 16 and 23 and Site 23 when pupae were present. Some adults emerged on July 12, 1969, from galls still containing pupae on July 16 at Site 24.

Gall

Description. The mature gall is a slight swelling of the vegetative stem and is covered by long white trichomes (Fig. 41). Its sclerenchymatous larval capsules are found between the woody tissues and the outer layers of stem tissue. The galled stem may be slightly bent or, if larvae are near the apex of the gall, it may be stunted.

Forty mature galls from Sites 23 and 24 were measured with the length of the stem surface covered by long trichomes ranging from 4-19 mm (avg. 9). The length of the trichomes ranged from approximately 1 to 2 mm. The galls contained from 1-7 larval chambers (avg. 2).

Developing galls were first observed in early June and found to differ from mature galls only in size. Galls were mature in mid-July when the larvae and pupae were well encapsulated within the stem and normal ephemeral leaves were mature. The old galls persisted on the plant for a year or more.

Effect on the plant. Some of the stems with galls died soon after midge emergence while others maintained their normal functions and produced new growth the next season. Galls were never found sufficiently abundant to cause more than slight damage to plants.

Associated insects

Platygasteridae. Platygaster sp. was found to parasitize this midge species.

Chalcidoidea. Torymus aeneoscapus and an undetermined species of Eupelmidae were reared from these galls.

Host plants and distribution of specimens studied

Artemisia tridentata tridentata: IDAHO: Lincoln Co: 11 mi W Kimama, 4275 ft (holotype male, and 3 males, 4 females, and 4 pupae, paratypes); Minidoka Co: 2 mi E Acequia, 4200 ft (10 pupae, paratypes).

Rhopalomyia tumidicaulis Gagné, new species
(Figs. 42, 71, 72)

Diagnosis

This species and R. hirticaulis form the only stem galls known on A. tridentata. Both species are generally similar with identical genitalia and strong tarsal claws, but R. tumidicaulis pupae have bilaterally compressed and more strongly sclerotized antennal horns, and adults have 2-segmented palpi.

Description

Male. Wing length, 1.9-2.0 mm. Eyes at vertex separated by less than one facet diameter. Antenna with 13-14 flagellomeres; neck flagellomere III approximately 0.5-0.6 length node; neck V, 0.5 length node; neck VII, 0.5-0.6 length node. Fused labella ellipsoid in frontal view, 304 setae per labellum. Palpus 2-segmented, segment I longer # than II, with 0-seta, segment II short ovoid, with 2-3 setae. Frontoclypeus with 1-4 setae per side. Anepisternum with 4-11 setae. Claws strong, toothed. Empodia as long as claws. Abdomen: tergum III with 10-13 setae per side, V with 10-13, VII with 9-16, and VIII with 12-13, the setal groups not contiguous mesally; pleura without sclae, segment VII with 0-2 setae, VIII with 3-4, sterna II-VII each with basal pair of trichoid sensilla, sternum VII with 13-14 setae in distal group, 20-26 in basal, these continuous across sternum. Genitalia: basimere very wide at base, tapering abruptly, then gradually to narrow apex; telomere ovoid, tooth wide; sternum X truncate.

Female. Wing length, 1.5-1.6 mm. Antenna with 13 flagellomeres, none with distinct necks. Other head and thoracic characters as in male. Abdomen: tergum III with 5012 setae, V with 11-15, and VII with 10-13; pleura naked; sterna II-VII each with basal pair of trichoid sensilla; sternum VII with 21-23 setae in distal group, 10-13 in basal; tergum VII 0.35-0.37 times length distal half of ovipositor.

Pupa (Figs. 71-72). Antennal horn short, strongly sclerotized ventrally and bilaterally compressed. Frons with pair of projections laterad of base of clypeus. Pronotum long, projecting slightly ventrad.

Holotype, male, 15 mi S Nampa, Canyon Co., Idaho, IX-4-1968, Artemisia tridentata wyomingensis, R. G. Jones, USNM Type No. 66645.

Biology

Seasonal occurrence. Adults emerged September 19-25, 1968 from galls collected on September 4 with pupae present.

Gall

Description. This polythalamous gall (Fig. 42) reaches maturity in the early fall just prior to bloom. It forms a swelling on a vegetative stem that becomes stunted, has numerous nodes and has small malformed leaves. Interspersed among the wood fibers of the inner stem are the sclerenchymatous larval capsules.

The length of nine of these stunted stems ranged from 5-23 mm (avg. 15). Three galls contained six, seven and eight larval capsules respectively.

Associated insects

Platygasteridae. Platygaster sp. was reared from these galls.

Chalcidoidea. Tetrastichus sp. and an undetermined species of Pteromalinae were reared from these galls.

Host plants and distribution of specimens studied

Artemisia tridentata wyomingensis: IDAHO: Canyon Co: 15 mi S Nampa, 2500 ft (holotype and 4 males, 10 females, and 1 pupa, paratypes).

APPENDIX

Other Nearctic Species of Rhopalomyia (Diarthronomyia)

by R. J. Gagné

All the described species of North American Diarthronomyia that occur on plants other than Artemisia tridentata or not in Idaho are listed below. Nine such species are known and they occur on other Artemisia species and cultivated Chrysanthemum spp. A diagnosis of the gall midges and galls and type information is given for each. The scientific names of Nearctic Artemisia hosts are given as originally cited (with any misspellings and without author names) at the time of the insect descriptions because it is impossible now to know if the identifications were accurate.

Rhopalomyia alticola CockerellRhopalomyia alticola Cockerell 1980-281.

Diagnosis

Only a gall remains of the type series in the USNM. Cockerell subsequently collected more adults which were described by Felt (1915b). These are medium-sized with a wing length of 2.0 mm in the male, 1.6 mm in the female, have 1-segmented palpi, simple claws, a pair of basal trichoid sensilla on each of abdominal sterna II-VII, and numerous setae on the abdomen. The telomeres of the male genitalia are short-ovoid and the apical teeth appear narrow. Rhopalomyia alticola differs from all other Nearctic Diarthronomyia in that the empodia are noticeably longer than claws.

Types. Male, female, pupa, larva, and gall, West Cliff, Colorado, emerged IV-24 (and earlier) 1890 from ? Artemisia canadensis, T. D. A. Cockerell; gall in USNM, other type specimens unaccounted for. Other specimens examined: 2 males, 2 females, Boulder, Colorado, (emerged) I-1907, A. canadensis, T. D. A. Cockerell.

Gall

The gall is a spherical mass of long trichomes, about 15 mm in diameter. It consists of an aggregate of several capsules each of which encloses a larva. From the figure in Felt (1940), the gall appears to be either a node or bud gall.

In the original description (Cockerell, 1890), the host of R. alticola was given as "a composite . . . a Chrysopsis or Solidago." Cockerell (1909) subsequently recorded the host as "Artemisia canadensis." Felt (1917) later listed "Artemisia forwoodii (? canadensis)" and, questionably, A. caudata as hosts. Baker (1895) reported a similar gall on "A. dracunculoides."

Rhopalomyia betheliana CockerellRhopalomyia betheliana Cockerell 1909:150.

Diagnosis

Wing length is 1.7-1.8 mm in the male, 1.3-1.4 mm in the female. The palpi are 1-segmented, the claws simple, trichoid sensilla are present on the abdominal sterna, and setae on the mouthparts and abdomen are scarce. The pupa resembles that of R. lignea with its very elongate antennal horns, but the pronotal setae of R. betheliana are approximately as long as the horns.

Gall

This is monothalamous, pyriform, approximately 34 mm long by 2 mm in basal diameter. It is covered with trichomes and occurs on the flower buds (cf. Fig. 335, Felt 1940).

Types. Lectotype male, here designated, Denver, Colorado, emerged III-1909, "Artemisia frigida", in USNM. Paralectotypes, 6 males, 7 females, and 5 pupal exuvia, all with same data as lectotype.

Rhopalomyia chrysanthemi (Ahlberg)Diarthronomyia hypogaea: Felt 1915a:267 (not F. Loew 1885)Diarthronomyia chrysanthemi Ahlberg 1939:276

Diagnosis

Wing length is 1.6-1.9 mm in the male, 1.4-1.7 in the female. The palpi are 2-segmented and the claws toothed. The basimere of the male genitalia has a ventral lobe and the elongate-ovoid telomere tapers gradually from midlength to the wide, apical tooth. The pupal antennal horns resemble those of R. obovata or R. nucula except that they are more pointed and the frontal ridges basad of the horns are not present in R. chrysanthemi.

Types. Lectotype male, here designated, labelled "E. Lansing, Mich., R. H. Pettit, 12611". It presumably was reared from commercial chrysanthemums from Adrian, Michigan (Felt, 1915a). Paralectotypes, 8 males, 9 females, 2 pupae, same data as lectotype. Ahlberg (1939) provided a name for the species misidentified by Felt (1915a) as Rhopalomyia hypogaea but designated no types and gave no specific data for specimens in his own collection. It seems proper, therefore, to use a specimen from Felt's series referred to in Ahlberg (1939).

Gall

This is a small, monothalamous, and conical gall occurring on the leaves, young stems, sepals, and buds of commercially grown chrysanthemums. It is not known from wild chrysanthemums and its geographical origin is conjectural. It was, at one time, almost cosmopolitan (Barnes 1948, q.v. for complete historical and economic review of this species). This gall was first identified as Rhopalomyia hypogaea (Loew) by Felt (1915a), who assumed it had

been introduced to North America on commercial plant stock from Europe. After the misidentification was corrected (Ahlberg 1939), Barnes (1939) suggested that R. chrysanthemi had been introduced into England and Europe separately from America because of the fact it was first noticed here in 1901 (Essig 1916). But perhaps the species originated in the eastern Palearctic Region. Monzen (1937) described the Japanese R. chrysanthemum from galls on Chrysanthemum morifolium Hemsl. that are similar to those of R. chrysanthemi. That plant is a native Asian species from which many horticultural varieties have been developed. Yukawa (1971) has suggested that R. chrysanthemum and R. chrysanthemi are synonymous.

Rhopalomyia clinata Gagné

Diarthronomyia californica Felt 1912:752, Junior secondary homonym of
Rhopalomyia californica Felt 1908.

Rhopalomyia clinata Gagné 1975:483, new name for californica (Felt 1912a)

Diagnosis

This is a tiny species with a wing length of 1.5-1.6 mm in the male, 1.1-1.2 mm in the female. It has 1-segmented palpi, toothed claws, trichoid sensilla on the abdominal sterna, and males have a ventral lobe on the short basimere. The adults could pass for those of R. occidentalis, but the pupa of R. clinata is similar to that of R. cramboides with its short antennal horns and frontal projections.

Types. Lectotype, male, here designated, Claremont, Los Angeles Co., California, C. F. Stahl, emerged III-12-1912, "Artemisia californica", C a2269, USNM Type No. 29261. Paralectotypes, 4 males, 3 females, and galls in USNM, and male, 3 females, and galls in Felt Collection, all with same data as lectotype.

Gall

This is small, brown, monothalamous, subconical, thin walled, naked, and protrudes at an oblique angle from the surface of the leaf. The gall is figured in Felt (1940).

Rhopalomyia coloradella Cockerell

Rhopalomyia coloradella Cockerell 1904:155.

Diagnosis

Only a male remains of the type series in the USNM. It has a wing length of 1.61 mm, the palpus is 1-segmented, the claws are simple, the abdominal sterna each have a pair of basal trichoid sensilla, the basimere appears to have a mesoventral lobe, and the telomere is short-ovoid with a narrow tooth. With this combination of characters, the specimen does not fit any of the bud gall makers on A. tridentata.

Types. Lectotype, male, here designated, Colorado Springs, Colorado, Artemisia sp., USNM Type No. 8250. Other specimens, at least one each of

female, pupa, larva, and gall, and possibly another male, all with same data as lectotype, probably lost.

Gall

Cockerell (1904) described it as a deformed flower head, about 10 mm long by 5.6 mm broad and covered by the greatly enlarged involucral bracts, which are outwardly smooth, reddish to yellowish, and inwardly covered with white trichomes. The host was given only as "Artemisia sp." Inasmuch as Rhopalomyia spp. appear to have narrow host preferences, future identification of R. coloradella should be difficult.

Rhopalomyia floccosa (Felt)

Diarthronomyia floccosa Felt 1916b:195.

Diagnosis

The females have a wing length of 1.2-1.3 mm, 1 segmented palpi, toothed claws, and sparse abdominal setae. Males are unknown.

Types. Syntypes, 2 females, from galls on "Artemisia californica" found on ridge between Mill Valley and Muir Woods, Marin Co., California, emerged XI-20 to 28, 1912, P. H. Timberlake. Type galls are probably lost. Other specimens examined: galls, Santa Barbara, California, Felt Collection C1628.

Gall

This is large and woolly. It is figured in Felt (1940), and is known from Marin and Santa Barbara Counties, California.

Rhopalomyia gnaphalodis Felt

Rhopalomyia gnaphalodis Felt 1911:484.

Diagnosis

Females have a wing length of 1.7-1.8 mm, have 2-segmented palpi, toothed claws, 16-17 antennal flagellomeres, and basal trichoid sensilla on the abdominal sterna. Males are unknown.

Types. Lectotype, female, here designated, Boulder, Colorado, emerged IV-25 to 29-1910 from "Artemisia heterophylla", P.H. Timberlake, C 1633, in Felt Collection. Paralectotypes, 2 males, 3 females, leaf with galls, same data as lectotype; galls on buds of "A. heterophylla", Puente Hills, near Whittier, Los Angeles Co., California, presumed lost; leaf with galls from "A. tridentata", Salt Lake City, Utah, V-1915, in USNM (these probably are made by R. hirtibulla).

Gall

This is a tiny, monothalamous, cylindrical, oblique leaf gall. Felt (1916b) lumped together under this species galls from "Artemisia heterophylla" and "A. tridentata", from California and Utah, respectively, presumably

because of superficial similarity. The described adults, however, were from leaf galls on "A. heterophylla."

Rhopalomyia subhumilis Gagné

Rhopalomyia subhumilis Gagné 1977:426.

Diagnosis

This species has a 2-segmented palpus, toothed claws, a ventral-lobed male basimere, a short, wide-toothed telomere, and pupal frontal projections and well-developed antennal horns. The pupal head will readily distinguish R. subhumilis from other Diarthronomyia with 2-segmented palpi and toothed claws.

Types. Holotype male, nr. Ephraim, Sanpete Co., Utah, in USNM. Paralectotypes, same data, in USNM, Brigham Young University, and California Academy of Sciences.

Gall

The gall is a polythalamous nodule on underground parts of the herbaceous Artemisia ludoviciana (Nuttall.). Ranasinghe (1978) reported on the bionomics of R. subhumilis in Utah.

Rhopalomyia tridentatae Rübsaamen

Rhopalomyia tridentatae Rübsaamen 1893:163.

Diagnosis

Wing length of the male is 2.1 mm, of the female, 1.6 mm. This is the only sagebrush gall midge in North America with the combination of 2-segmented palpi and simple claws. The male basimere has a mesoventral lobe and the telomere is ovoid with a wide, apical tooth.

Types. Lectotype, male, here designated, North American, from "Artemisia tridentata", in Rübsaamen Collection, Zoologisches Museum, Berlin (that collection currently on loan to Staatliches Museum für Naturkunde, Stuttgart, West Germany). Paralectotype, female, same data as male.

The type locality was originally and subsequently listed only as "North America" and, although the type specimens bear no further locality data, the locality can possibly be narrowed to California. The adults specimens were sent to Rübsaamen by Dietrich von Schlechtendahl, an entomologist at the University of Halle in Germany. Essig (1931), in his History of Entomology, mentions Schlechtendahl only in the biography of H. H. Behr (1818-1904) in the list of the latter's scientific friends. It is possible that Behr sent the specimens to Schlechtendahl, an old friend and colleague in Halle. Behr came to California in 1851 and, except for a brief visit to Germany, never left the state (Essig 1931). An indication that a gall similar to one attributed to R. tridentatae does occur in California is Felt's (1915b) statement that there was a gall from California in the Museum of Comparative Zoology in Cambridge that might be attributable to this species. RJG has been unable to locate

this specimen.

Gall

Rübsaamen (1893) stated that the adults were reared from a gall on "Artemisia tridentata" similar to that formed by the European R. artemisiae (Bouché) on "Artemisia campestris", viz. a pea-sized, ovoid, bud-like flower gall (Fig. 1303, Vol. 2, Houard 1909). No gall fitting that description was found in Idaho during the course of this study.

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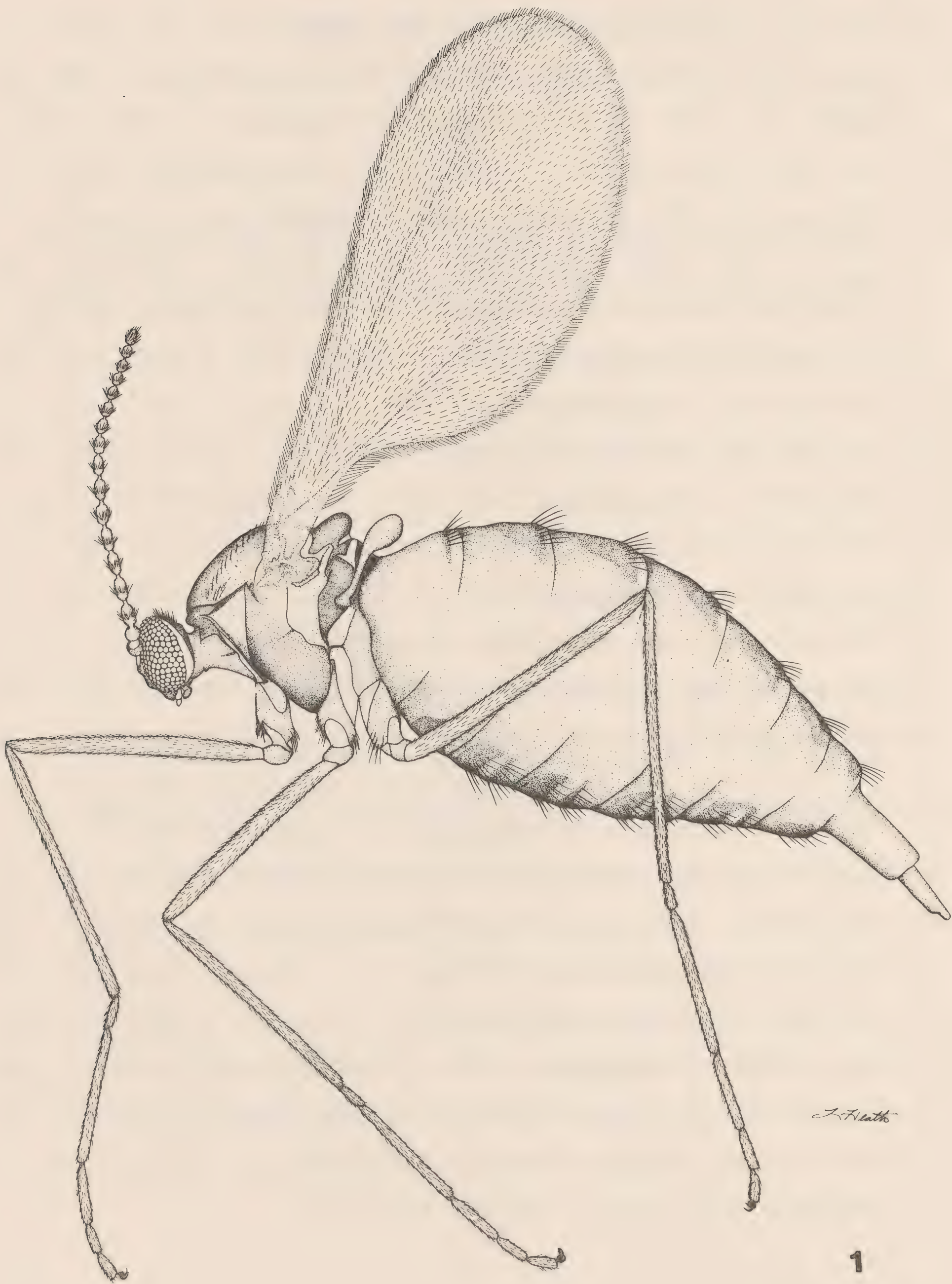
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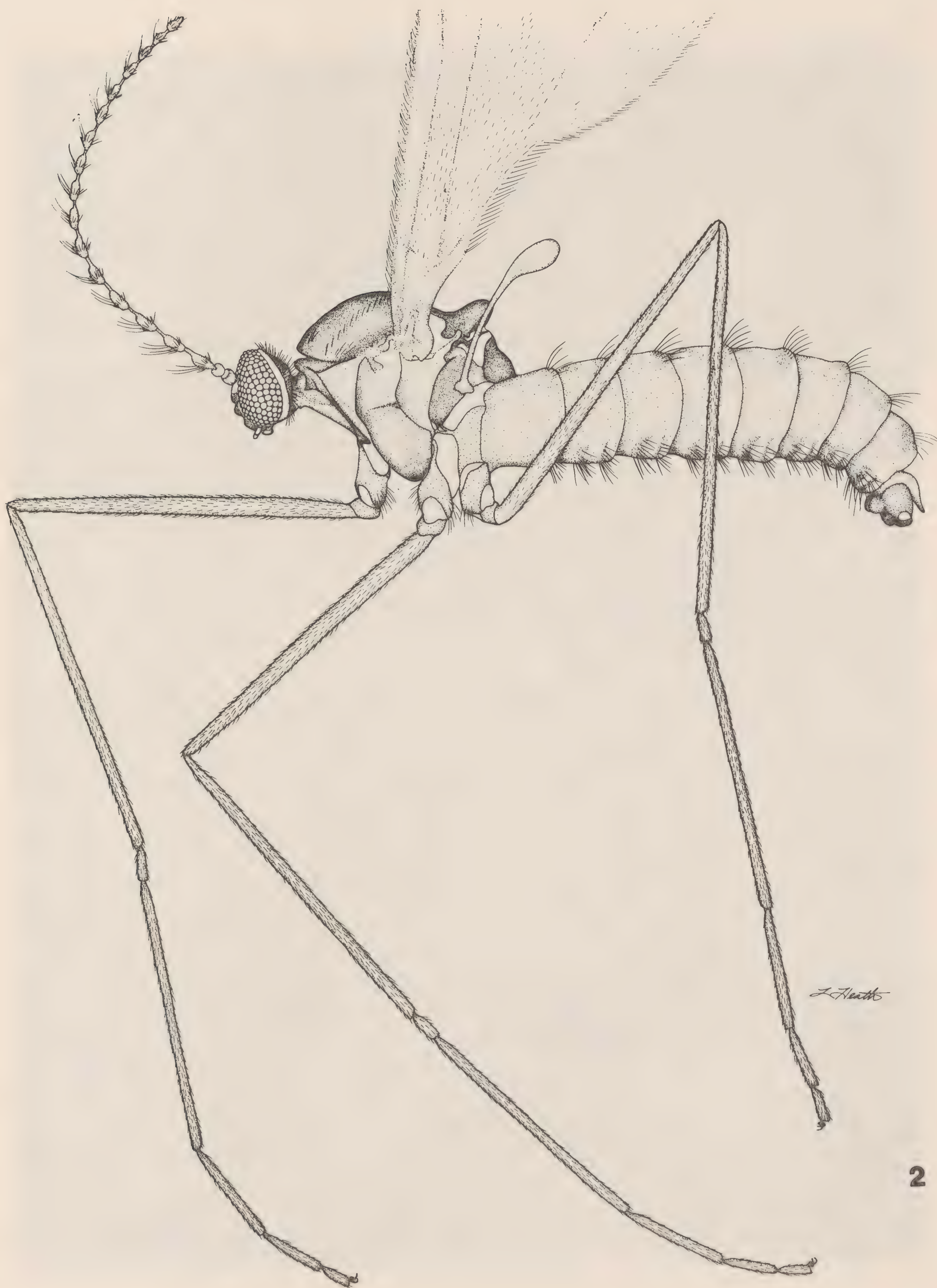
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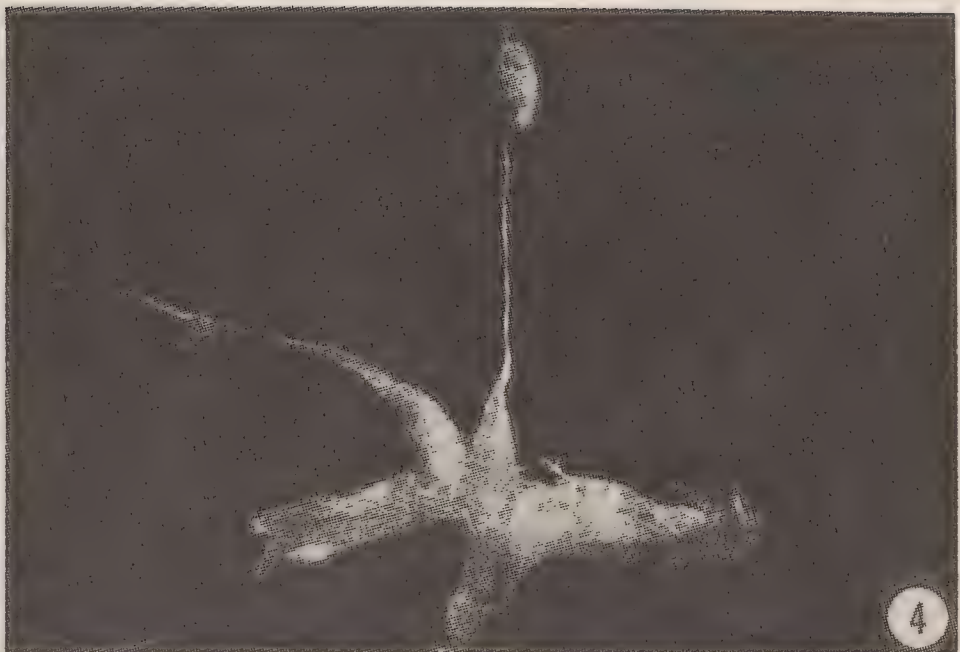
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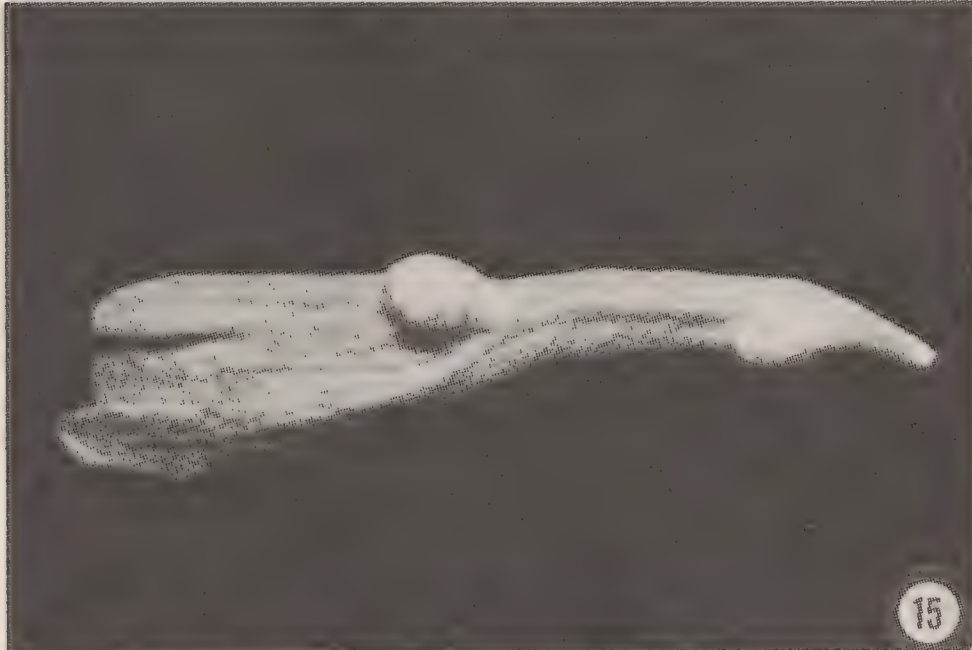
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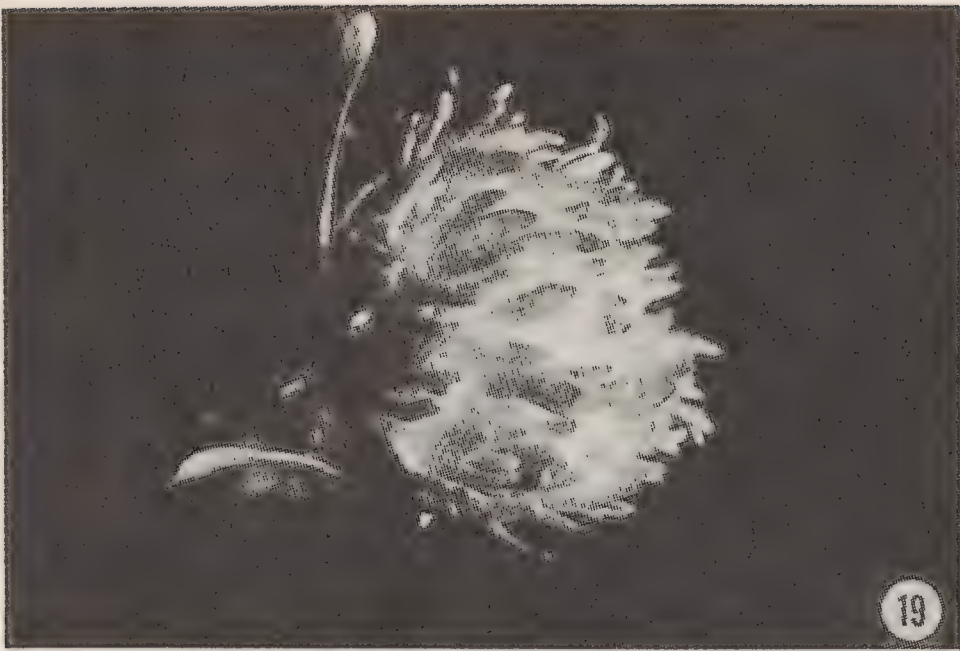
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95. Male genitalia R. obovata (5 mi E Twin Falls, ID)



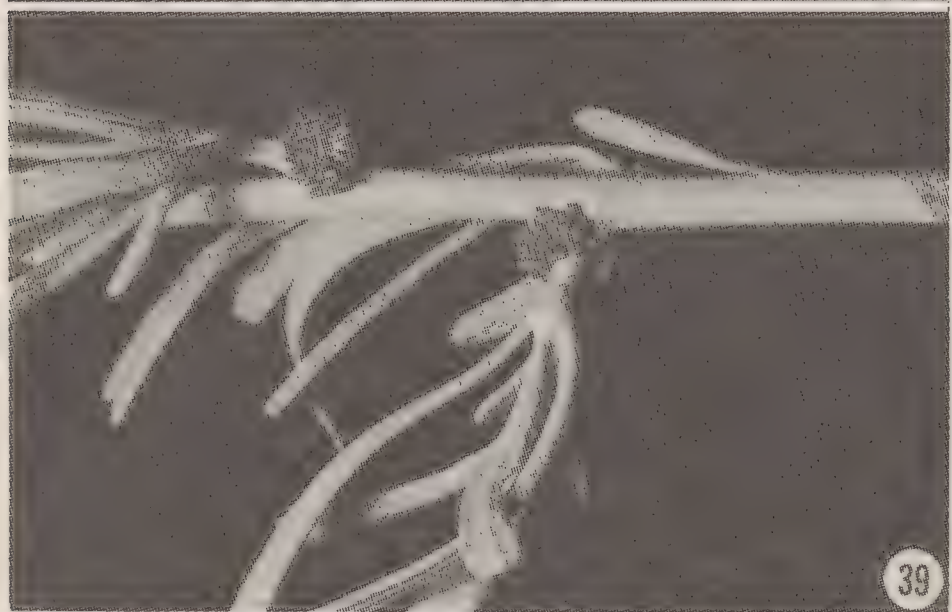
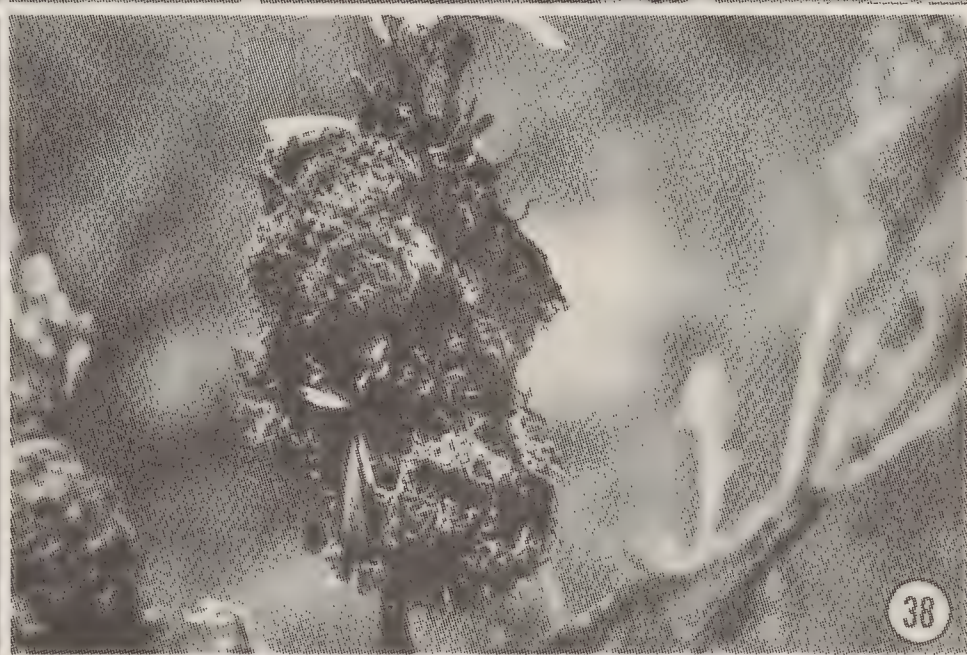


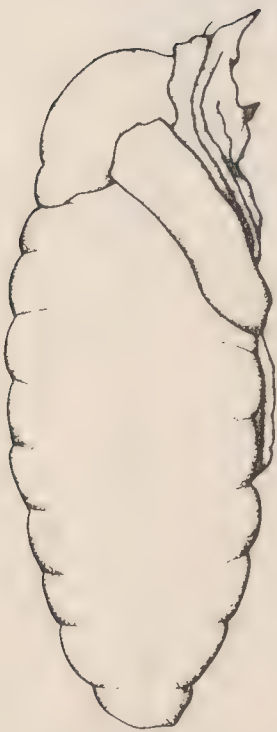












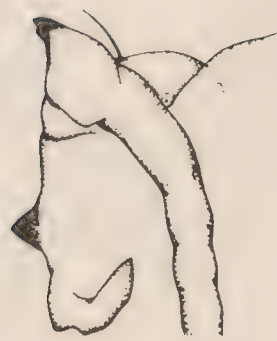
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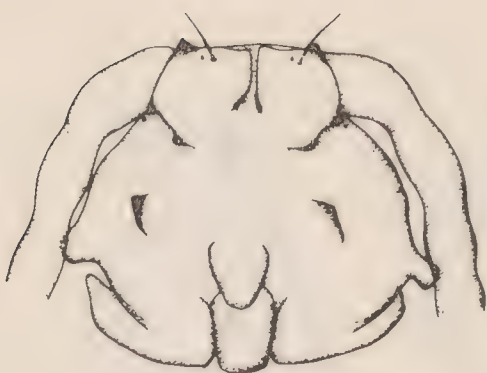
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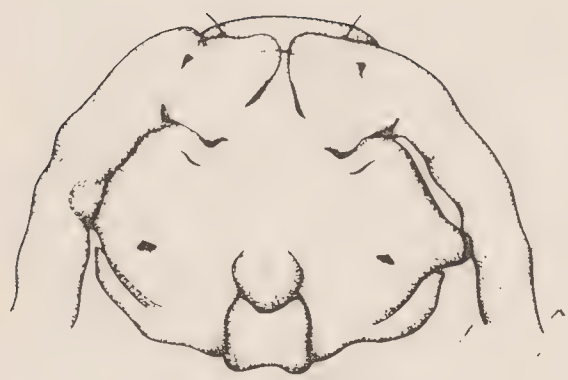
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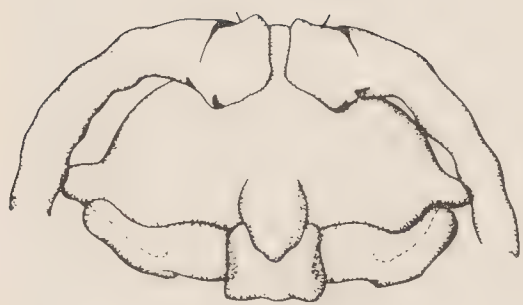
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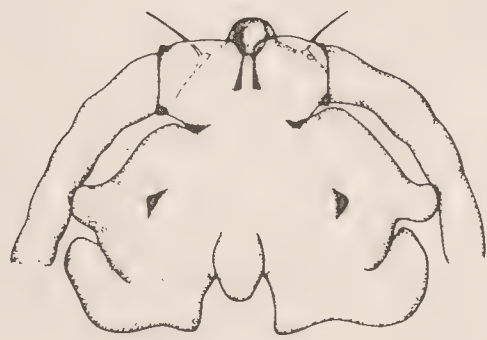
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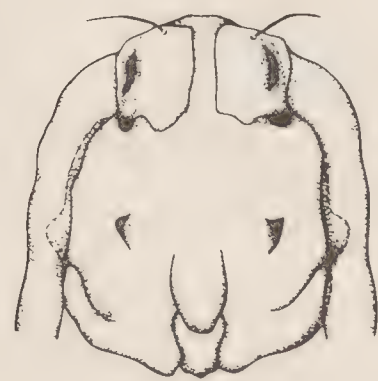
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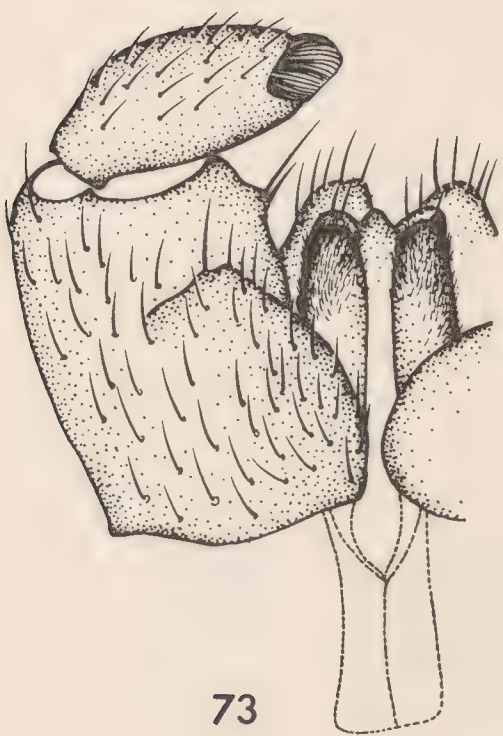
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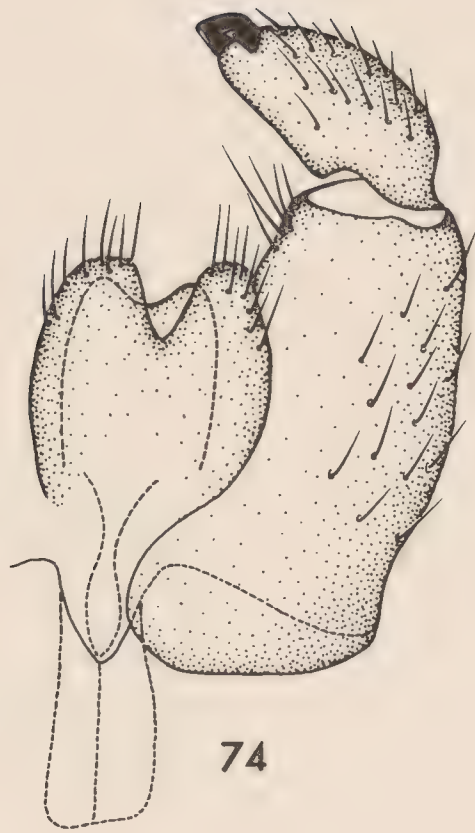
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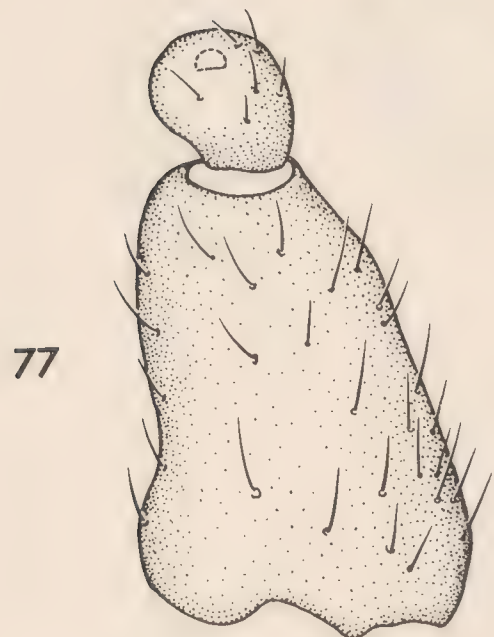
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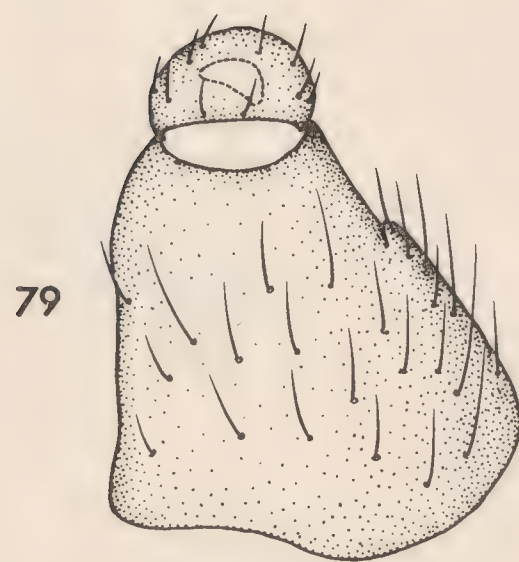
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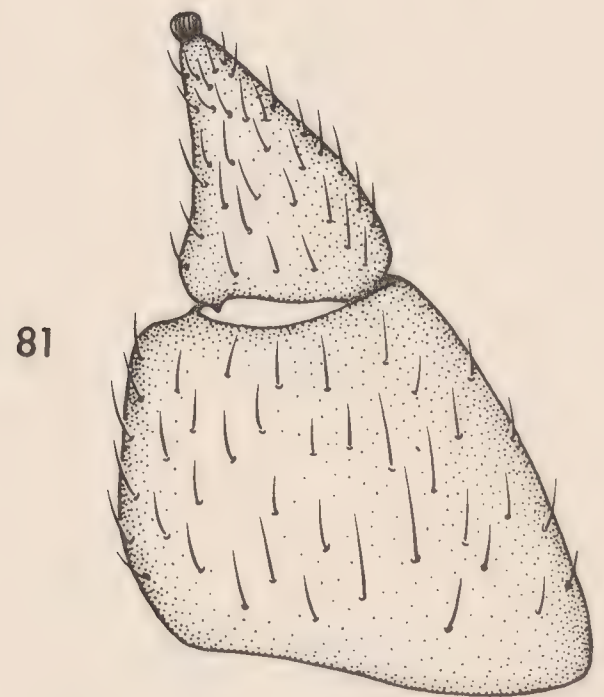
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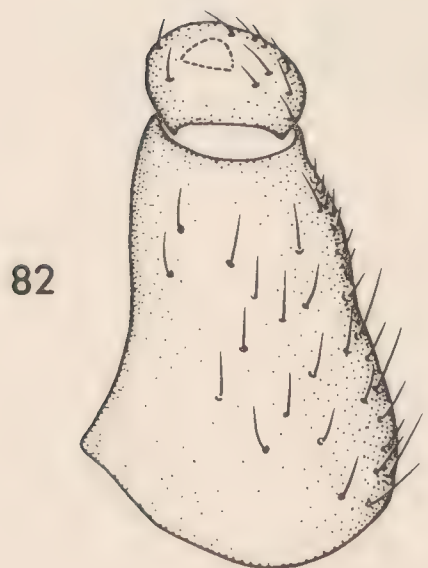
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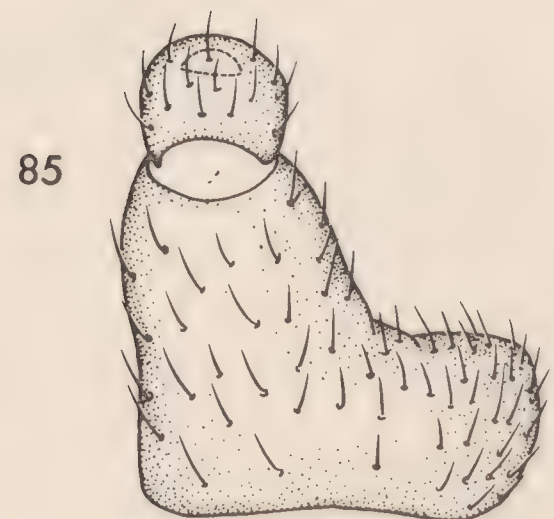
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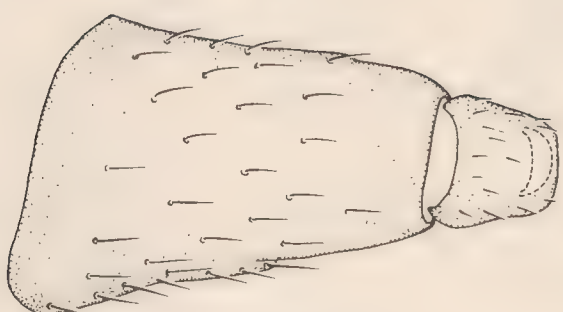
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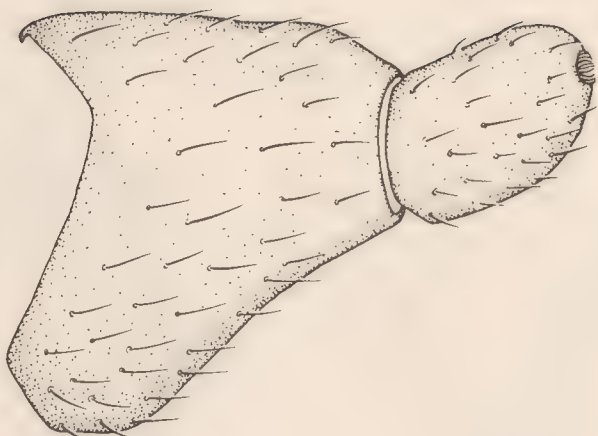
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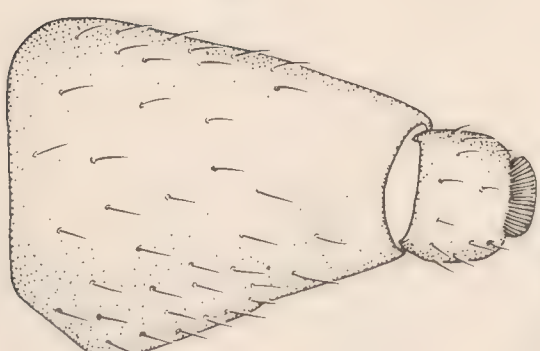
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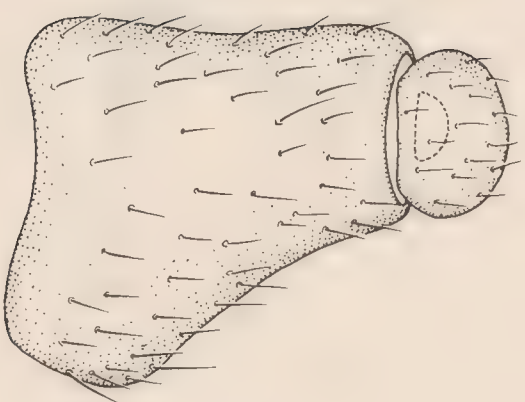
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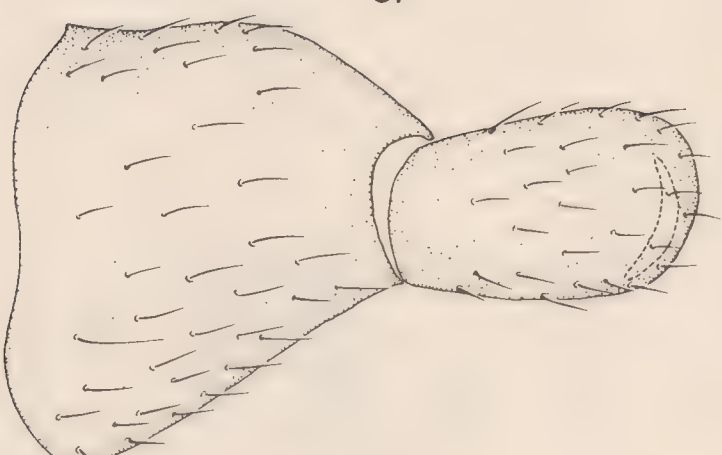
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RHEOPHILIC AND HYPORHEIC
WATER MITES OF NEW ZEALAND

By David R. Cook

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RHEOPHILIC AND HYPORHEIC WATER MITES OF NEW ZEALAND¹

David R. Cook
Wayne State University

INTRODUCTION

This publication is the first in a series dealing with the water mites of regions which were formerly part of Gondwanaland. The present work is based largely on collections made by the author during a collecting trip to New Zealand in October and November of 1982. Also included are two species described by Ceri Hopkins which were not recollected. A total of 93 species are illustrated and described, 73 of which are new. This paper serves two purposes. First, it greatly increases the known species of New Zealand water mites and, as the results appear as a single unit, should be useful to the non-specialist in identifying local species. To the latter end, keys are included for the more species-rich groups, *Flabellifrontipoda*, *Limnesia*, *Australiobates* and the Notoaturinae, and these taxa constitute nearly three-fourths of the known hydrachnid fauna. Secondly, the descriptions will serve, when combined with the future descriptions of water mites from other Gondwanan areas, as the basis for phylogenetic analyses of the relationships of the southern hydrachnids. Once these relationships have been satisfactorily worked out, the data can be used to determine the zoogeographic history of these mites.

As the title suggests, collecting was confined almost exclusively to flowing water situations. One exception was made, and Lake Ianthe on South Island was sampled to see if close relatives of the stream inhabiting species might not also occur in large, cool oligotrophic habitats. Three species were taken, of which, two belonged to predominately lentic groups, *Piona* and the typical subgenus of *Arremurus*. The third species, a *Flabellifrontipoda*, is very closely related to one of the rheophilic species. The fact that this number of additional species was taken in a single collection suggest there are still many unknown forms in New Zealand lakes which, although they are much less zoogeographically interesting than the rheophilic mites, will increase the number of known hydrachnids of the country when adequate sampling is carried out. A rather large percentage of the stream inhabiting mites appear to be interstitial (= hyporheic) and these are discussed on page 124.

Nearly all the previous work on New Zealand water mites has been published by three individuals, Ceri Hopkins, Taiji Imamura and Vida Stout, and all of their relevant papers are included in the references section, whether or not they are cited in the text.

Primary types are to be deposited in the National Museum, Wellington. Measurements for the holotype and allotype are given first. If a number of paratypes are available, size variation is given in parentheses following the measurements of the primary types. In the case of previously described species, only the range of variation is presented.

¹Contribution no. 406 from the Department of Biological Sciences, Wayne State University. This work supported by a grant (DEB-8108264) from the National Science Foundation.

I wish to express my appreciation to Drs. Ceri Hopkins, Graeme Ramsay and Vida Stout for aiding the author in various ways either before or during the stay in New Zealand. Thanks also go to Dr. Francis Sanders for preparing the light microscope photographs and to Dr. Carmel Harkins for the scanning EM pictures. Special thanks go to my wife, Alice, for the good company, excellent map reading, and countless hours spent hunched over a collecting pan during the trip.

SYSTEMATIC SECTION

Subfamily ZELANDOTHYADINAE, new subfamily

Diagnosis: A red water mite with a soft, papillate integument; dorsal sclerites consisting of paired lateral eye plates placed at right angles to the long axis of body near anterior end; eyes pigmented; a reticulate, median plate surrounding the postocularia present posterior to the eye plates (fig. 9); coxae in four groups, with extensive associated apodemes, especially on posterior pairs (fig. 3); genital field with movable genital flaps partially covering three pairs of genital acetabula (fig. 5); acetabula slightly stalked; legs with numerous short setae but no swimming hairs; claws with numerous very small clawlets on each side (fig. 11); capitulum attached to a tube of soft integument to form protrusible mouthparts; capitulum normally completely withdrawn into the body; cheliceral claw long and stylet-like; dorsodistal portion of P-IV with two heavy setae; P-V with three small subterminal setae (fig. 8).

Type Genus: *Zelandothyas*, new genus, with the characters of the subfamily and *Z. diamphida* is the type species.

Discussion: Adults of the genus exhibit a mixture of character states used to define the superfamilies Eylaoidea and Hydryphantoidea and, at present, the superfamily assignment is uncertain. An engorged larva was taken in one of the stream collections and allowed to metamorphose into a nymph assignable to the present mite. The cast larval integument is somewhat distorted but the important characters should be observable. This larva is to be described by Ian Smith and, as larvae usually are better indicators of higher relationships, will likely permit it to be placed with certainty in a superfamily and give hints as to its nearest relatives at the family level. It almost certainly belongs in a separate family but, as I have a distinctive new genus from Tasmania which appears to be close enough to be placed in the same family, wish to delay a family diagnosis until the latter can be incorporated. Autapomorphic character states of the present genus include the unusual lateral eye plates and median dorsal plate, as well as the unusual apodemes associated with the posterior coxal groups. The palp is somewhat "*Limnochares*"-like, but the two dorsodistal heavy setae on P-IV appear to be apomorphic. However, the new genus from Tasmania also shares a somewhat similar palp, including the two heavy setae on P-IV.

1. Zelandothyas diamphida, new species

(Figs. 1-9, 11)

Female: Body soft, integument papillate; body color a bright orange; body, not including the extensible capitulum, approximately $1370\mu\text{m}$ - $1520\mu\text{m}$ in length; lateral eyes pigmented and lying on narrow sclerites arranged at right angles to long axis of body; a median, reticulate sclerite which surrounds the postocularia

lying immediately posterior to eye sclerites; this sclerite $532\mu\text{m}$ ($502\mu\text{m}$ - $608\mu\text{m}$) in length, $304\mu\text{m}$ ($304\mu\text{m}$ - $319\mu\text{m}$) in width; structure of these dorsal sclerites better illustrated (figs. 6, 9) than described; glandularia placed on non-papillate portions of the integument rather than on actual sclerites; anterior coxal groups close together medially and with posteriorly directed apodemes on posterior margins of second coxae; posterior coxal groups narrow and placed far apart on their respective sides; third coxae placed at right angles to long axis of body, fourth coxae extending more or less directly posteriorly; two extensive apodemes extending anteriorly from anterior margin of third coxae; the more lateral of these apodemes extending posteriorly below the lateral margin of the fourth coxae (indicated by broken lines in figure 1); coxae with numerous setae (fig. 3); genital field consisting of well developed genital flaps with irregular medial margins, these $214\mu\text{m}$ ($200\mu\text{m}$ - $214\mu\text{m}$) in length; three pairs of genital acetabula regularly arranged medial to the flaps; the acetabula are actually somewhat stalked; figure 5 illustrates the structure of the genital field; excretory pore is only a slit in a non-papillate portion of integument rather than on a sclerite; capilulum attached to a tube of soft integument forming protrusible mouthparts; capilulum $288\mu\text{m}$ ($296\mu\text{m}$ - $303\mu\text{m}$) in length and is narrowed anteriorly and the mouth opening is terminal; chelicera $318\mu\text{m}$ ($311\mu\text{m}$ - $318\mu\text{m}$) in length; cheliceral claw long and gradually tapering to a sharp point; figure 2 shows the structure of the chelicera; dorsal lengths of the palpal segments: P-I, $8\mu\text{m}$ ($7\mu\text{m}$ - $8\mu\text{m}$); P-II, $34\mu\text{m}$ ($32\mu\text{m}$ - $33\mu\text{m}$); P-III, $38\mu\text{m}$ ($35\mu\text{m}$ - $38\mu\text{m}$); P-IV, $59\mu\text{m}$ ($62\mu\text{m}$ - $64\mu\text{m}$); P-V, $31\mu\text{m}$ ($32\mu\text{m}$); chaetotaxy of P-I, II and III simple; P-IV with two dorsal, thickened setae; P-V with three small subterminal setae; figure 8 shows the structure of the palp; figure 7 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $148\mu\text{m}$ ($150\mu\text{m}$ - $155\mu\text{m}$); I-Leg-5, $170\mu\text{m}$ ($163\mu\text{m}$ - $170\mu\text{m}$); I-Leg-6, $177\mu\text{m}$ ($170\mu\text{m}$ - $179\mu\text{m}$); figure 4 illustrates these segments; setae numerous on all legs; swimming hairs absent; claws with lateral serrations (fig. 11).

Male: Except for averaging slightly smaller, male is nearly identical in external morphology, and only measurements are given. Body approximately $1150\mu\text{m}$ - $1290\mu\text{m}$ in length; reticulate dorsal plate $547\mu\text{m}$ ($478\mu\text{m}$ - $502\mu\text{m}$) in length, $274\mu\text{m}$ ($278\mu\text{m}$ - $289\mu\text{m}$) in width; acetabular plates $192\mu\text{m}$ ($185\mu\text{m}$ - $192\mu\text{m}$) in length; capitulum $266\mu\text{m}$ ($252\mu\text{m}$ - $266\mu\text{m}$) in length; chelicera $270\mu\text{m}$ ($263\mu\text{m}$ - $273\mu\text{m}$) in length; dorsal lengths of the palpal segments: P-I, $5\mu\text{m}$ ($7\mu\text{m}$); P-II, $31\mu\text{m}$ ($26\mu\text{m}$ - $29\mu\text{m}$); P-III, $31\mu\text{m}$ ($32\mu\text{m}$ - $34\mu\text{m}$); P-IV, $56\mu\text{m}$ ($54\mu\text{m}$ - $55\mu\text{m}$); P-V, $26\mu\text{m}$ ($26\mu\text{m}$ - $27\mu\text{m}$); dorsal lengths of the distal segments of the first leg: I-Leg-4, $146\mu\text{m}$ ($133\mu\text{m}$ - $142\mu\text{m}$); I-Leg-5, $152\mu\text{m}$ ($145\mu\text{m}$ - $157\mu\text{m}$); I-Leg-6, $167\mu\text{m}$ ($170\mu\text{m}$).

Holotype: Adult ♀, from a tributary of the Whangamoa River on Rt. 6, somewhat west of Rai Saddle (at Collins Valley Picnic Grounds), South Island, Nov. 6, 1982.

Allotype: Adult ♂, same data as holotype.

Paratypes: 3 ♂, 1 ♀, same data as holotype; 2 ♂, 1 ♀, Whangamoa River on Rt. 6, approximately 5 km northeast of Whangamoa Saddle, South Island, Nov. 23, 1982.

Family HYDRYPHANTIDAE thor

Subfamily WANDESIINAE Schwoerbel

Genus EUWANDESIA Andre and Naudo

2. Euwandesia tenebrio Hopkins and Schminke

(Figs. 10, 12-15)

Euwandesia tenebrio Hopkins and Schminke, 1970. *Acarologia*, 12: 357.

Nymph: Body soft and elongated; integument papillate; body approximately 900 μm in length; lateral eyes with associated pigment, these lying on an oval anterior portion of body indistinctly set off by integumental folds (fig. 12); the homologs of the small, median postocularia sclerite characteristic of adults of this genus are two small separated sclerites (fig. 10); these sclerites 17 μm in length and bearing the postocularia; coxae as shown by Hopkins and Schminke for the adult; provisional genital field with two pairs of acetabula approximately 25 μm in diameter; the acetabula on each side set in pits in the integument; a single seta on the outer edge of one side (fig. 13); dorsal lengths of the palpal segments: P-I, 17 μm ; P-II, 40 μm ; P-III, 38 μm ; P-IV, 48 μm ; P-V, 28 μm ; P-V terminating in three enlarged setae; figure 15 illustrates the proportions and chaetotaxy of the palp; capitulum 170 μm in length; chelicera 174 μm in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 59 μm ; I-Leg-5, 69 μm ; I-Leg-6, 76 μm ; figure 14 shows these segments.

Material Examined: Five engorged larvae taken in a sand bar of the Kaeo River on Waiare Road, 4 km south of junction with Rt. 10, North Island, Oct. 21, 1982. One of these larvae allowed to metamorphose and a nymph of *tenebrio* emerged. The mature nymph, on which the description is based, was collected in bottom deposits of Whale Creek on Rt. 6, west of Murchison, South Island, Nov. 7, 1982.

Discussion: It is possible to see the beginnings of the integumental flaps which partially cover the acetabula in the adult. There is even a single seta on the medial margin of the flaps in the nymph, the same area which in the adult a row of setae are found. Also, the medial postocularia platelet of the adult is represented by a pair of widely separated platelets in the nymph (fig. 10).

Subfamily PSEUDOHYDRYPHANTINAE Viets

Genus PSEUDOHYDRYPHANTES Viets

3. Pseudohydrphantes bebelus, new species

(Figs. 16-22)

Female: Length of body 729 μm ; integument with low papillae; lateral eyes in capsules; median eye placed almost between the postocularia platelets; no dorsalia or lateralia present; sclerotization associated with glandularia forming a complete ring surrounding the gland portion; figure 20 shows the structure of the dorsum; length between anterior end of first coxae and posterior end of genital field 426 μm ; coxae in four groups; tips of first, second and third coxae with short thickened setae; genital field extending between posterior coxal groups; excretory pore on a well developed sclerite; figure 16 illustrates the ventral sclerites; genital field 192 μm in length, 120 μm in width; genital flaps relatively long and narrow; three pairs of genital acetabula, the first pair the longest (fig. 17); dorsal lengths of the palpal segments: P-I, 46 μm ; P-II, 78 μm ; P-III, 50 μm ; P-IV, 141

μm ; P-V, $41\mu\text{m}$; figure 19 illustrates the proportions and chaetotaxy of the palp; capitulum $207\mu\text{m}$ in length; chelicera $307\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $108\mu\text{m}$; I-Leg-5, $126\mu\text{m}$; I-Leg-6, $144\mu\text{m}$; figure 22 shows these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $177\mu\text{m}$; IV-Leg-5, $189\mu\text{m}$; IV-Leg-6, $185\mu\text{m}$; III-Leg-3 with two swimming hairs; III-Leg-4 with eight swimming hairs; III-Leg-5 with 10 swimming hairs; IV-Leg-3 with two swimming hairs; IV-Leg-4 with seven swimming hairs; IV-Leg-5 with eight swimming hairs; figure 18 illustrates IV-Leg-4-6.

Male: Unknown.

Holotype: Adult ♀, from the Hope River on Rt. 6, between Glenhope and Kawatiri, South Island, Nov. 25, 1982.

Discussion: This is the only known water mite genus with an amphiarctic distribution. In addition to the New Zealand mite, three undescribed species are known from Australia and three species have previously been described from the northern portion of the holarctic region. The relationships of these species will be discussed in a paper on the Australian hydrachnids. The completely sclerotized ring surrounding the glandularia is sufficient to distinguish the New Zealand form from any of the others.

Family SPERCHONTIDAE Thor

Subfamily APELTOSPERCHONTINAE Cook

Genus APELTOSPERCHON Besch

4. Apeltosperchon zelandicus, new species

(Figs. 23-28)

Female: Length of body $562\mu\text{m}$ ($532\mu\text{m}$ - $608\mu\text{m}$) in length; length between anterior end of first coxae and posterior end of genital field $319\mu\text{m}$ ($350\mu\text{m}$ - $364\mu\text{m}$); integument relatively smooth; dorsum without dorsalia but with small glandularia sclerites; eye lenses fused with the integument to form very low eye capsules, the anterior lens being much larger than the posterior lens (fig. 25); capitular bay large; anterior coxal groups separated medially; suture lines between first and second coxae branching, with one branch ending near tip of capitular bay; a gland on each side near tips of first coxae; a sclerotized strip on each side extending from anterior margin of third coxae to lateral margins of second coxae (fig. 27); no glandularia present on third coxae; length from anterior end of pregenital sclerite to posterior end of postgenital sclerite $140\mu\text{m}$ ($155\mu\text{m}$); width of genital field $78\mu\text{m}$ ($85\mu\text{m}$ - $89\mu\text{m}$); three pairs of genital acetabula; genital flaps close together posteriorly, but well separated anteriorly; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($19\mu\text{m}$ - $21\mu\text{m}$); P-II, $48\mu\text{m}$ ($48\mu\text{m}$ - $49\mu\text{m}$); P-III, $31\mu\text{m}$ ($31\mu\text{m}$ - $34\mu\text{m}$); P-IV, $52\mu\text{m}$ ($54\mu\text{m}$); P-V, $27\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); both P-II and P-III with a heavy seta near ventral side; a heavy terminal seta on P-IV; figure 26 illustrates the proportions and chaetotaxy of the palp; capitulum $107\mu\text{m}$ ($114\mu\text{m}$) in length; chelicera $148\mu\text{m}$ ($142\mu\text{m}$ - $159\mu\text{m}$) in length; figure 28 shows a lateral view of the capitulum and chelicera; dorsal lengths of the distal segments of the first leg: I-Leg-4, $69\mu\text{m}$ ($74\mu\text{m}$ - $76\mu\text{m}$); I-Leg-5, $76\mu\text{m}$ ($83\mu\text{m}$ - $89\mu\text{m}$); I-Leg-6, $87\mu\text{m}$ ($96\mu\text{m}$ - $103\mu\text{m}$); figure 23 shows these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-

4, $116\mu\text{m}$ ($131\mu\text{m}$ - $138\mu\text{m}$); IV-Leg-5, $118\mu\text{m}$ ($128\mu\text{m}$ - $141\mu\text{m}$); IV-Leg-6, $121\mu\text{m}$ ($128\mu\text{m}$ - $138\mu\text{m}$); figure 24 shows IV-Leg-5 and 6; swimming hairs absent.

Male: Unknown.

Holotype: Adult ♀, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), North Island, Oct. 27, 1982.

Paratypes: 1 ♀, from the headwaters of Whangamata Stream, 10 km northwest of Taupo, North Island, Nov. 3, 1982; 1 ♀, from a tributary of the Wakamarina River, 7 km southeast of Canvastown (off Rt. 6), South Island, Nov. 5, 1982.

Discussion: This is only the second species of the genus to be collected. The first, *Apeltosperchon schmitzi* Besch, was taken in the austral portion of Chile. The present species exhibits a much greater division into inner and outer portions of the second coxae. Also, the fourth coxae of *zelandicus* are only slightly longer than the third coxae and the palpal segments are proportionally shorter than in the species from Chile.

Family ANISITSIELLIDAE Koenike

Genus ANISITSIELLIDES Lundblad

5. Anisitsiellides arraphus, new species

(Figs. 29-35)

Female: Dorsal shield $608\mu\text{m}$ in length, $410\mu\text{m}$ in width; dorsal shield bearing the postocularia and four pairs of glandularia; a pair of ridges present near lateral margins; dorsal furrow wide and containing five pairs of glandularia sclerites; ventral shield $669\mu\text{m}$ in length, $471\mu\text{m}$ in width; no separate sclerite present at anterior end of ventral shield; "glands of the third coxae" shifted far forward to a position on the second coxae (fig. 29); median coxal suture line evident; posterior suture lines of fourth coxae nearly obliterated; genital field $140\mu\text{m}$ in length, $111\mu\text{m}$ in width; genital flaps bearing only a few setae; three pairs of genital acetabula; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$; P-II, $62\mu\text{m}$; P-III, $48\mu\text{m}$; P-IV, $100\mu\text{m}$; P-V, $22\mu\text{m}$; figure 32 shows the proportions and chaetotaxy of the palp; capitulum $98\mu\text{m}$ in length; chelicera $124\mu\text{m}$ in length; figure 33 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $83\mu\text{m}$; I-Leg-5, $93\mu\text{m}$; I-Leg-6, $117\mu\text{m}$; figure 31 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $107\mu\text{m}$; IV-Leg-5, $114\mu\text{m}$; IV-Leg-6, $79\mu\text{m}$; two very long swimming hairs present on IV-Leg-5; claws absent on IV-Leg-6; setae at tip of this segment short.

Male: Unknown.

Holotype: Adult ♀, from Te Whaiau Stream at junction of Rt. 47 and Rotorua Road, North Island, June 5, 1981.

Discussion: This is the second "typical" *Anisitsiellides* known from New Zealand. Hopkins (1967) described *A. zelandicus* from a stream in the Tararua Mountains of southern North Island. Both these New Zealand forms differ from the two described from South America in having a completely fused ventral shield. The two South American species have a separate anterior sclerite similar to that shown for the following species (fig. 36). The present species differs from *zelandicus* in having a proportionally much shorter IV-Leg-6 relative to IV-Leg-5 and the three ventral setae of P-IV are placed much closer to the

distal end.

6. Anisitsiellides partitus, new species

(Figs. 36-42)

Female: Dorsal shield $456\mu\text{m}$ in length, $319\mu\text{m}$ in width; dorsal shield bearing the postocularia and four pairs of glandularia; dorsal furrow wide and with four pairs of glandularia flanking the posterior two-thirds of the dorsal shield; ventral shield $486\mu\text{m}$ in length, $358\mu\text{m}$ in width; a separate sclerite present at anterior end of ventral shield; "glands of the third coxae" shifted forward to the second coxae (but not as far forward as in any of the previously described species of the genus); median coxal suture line evident; posterior suture lines of fourth coxae nearly obliterated; genital field $96\mu\text{m}$ in length, $74\mu\text{m}$ in width; genital flaps bearing a few setae; three pairs of genital acetabula; figure 36 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $14\mu\text{m}$; P-II, $47\mu\text{m}$; P-III, $27\mu\text{m}$; P-IV, $60\mu\text{m}$; P-V, $22\mu\text{m}$; setal tubercles on ventral side of P-IV prominent; figure 41 shows the proportions and chaetotaxy of the palp; capitulum $86\mu\text{m}$ in length; chelicera $96\mu\text{m}$ in length; figure 40 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $52\mu\text{m}$; I-Leg-5, $55\mu\text{m}$; I-Leg-6, $79\mu\text{m}$; figure 42 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $62\mu\text{m}$; IV-Leg-5, $66\mu\text{m}$; IV-Leg-6, $54\mu\text{m}$; one long swimming hair present on IV-Leg-5; claws absent on IV-Leg-6 (fig. 38).

Male: Unknown.

Holotype: Adult ♀, from Whale Creek on Rt. 6, west of Murchison, South Island, Nov. 7, 1982.

Discussion: The present species differs most noticeably from all other species of the genus, both in New Zealand and South America, in having the "glands of the third coxae" not extending as far anteriorly, in having a well developed setal tubercle on P-IV (fig. 40), and possessing only one swimming hair on IV-Leg-5.

Family OXIDAE Viets

Genus FLABELLIFRONTIPODA Lundblad

Discussion: Kurt O. Viets (1978b) reviewed *Flabellifrontipoda* and pointed out that a number of character states originally used to define the genus were not confined to *Flabellifrontipoda*. I am in agreement with most of his conclusions and much of what is written below is only a further elaboration of the three main characters he discussed. (1) Claws: The presence of a comb of numerous ventral clawlets on the claws (figs. 79, 88) is the only character state not found in other oxids. Utilizing other members of the superfamily Lebertioidea for out-group comparisons, it seems certain this claw morphology is derived for the genus *Flabellifrontipoda*. (2) Soft integumental projections at tip of first coxae: These projections appear to be artifacts of preservation and slide making. I believe them to be the linings of a pair of glands, with large openings, at tips of the first coxae. Each half of the gland is lined separately, so there usually are two integumental projections on each side. Depending on circumstances, both projections, one projection or none are everted. It seems that these linings are more likely to evert in *Flabellifrontipoda* than in other oxid genera, and they

do seem to show species differences. For example, they may be palmate as in the type species of the genus--similar to that shown in figure 57, or it may be pinnate (fig. 51) or smooth (fig. 66). However, the degree to which these structures evert is so variable as to make them unreliable for species diagnoses. (3) Median ventral suture line: This structure is probably the homolog of a rather extensive area of unsclerotized integument found in the nymphs of all oxids (fig. 99). As Viets points out, this suture is not always thin in *Flabellifrontipoda*, and more commonly is apt to be only a median pore-free area. I also found this variation in the New Zealand species. For permanent mounts of members of this genus I orient them in lateral view after separating a mite into right and left halves. In some species the specimen will break perfectly in two along the suture line, indicating the presence of thin integument in this area. In most of the species, however, even bending the two halves back and forth to cause them to separate rarely results in the break coming at the suture line. In these cases there has been much greater fusion at the suture line.

There are two species in Australia, including *Frontipoda tasmanica* Kurt O. Viets, which are somewhat *Flabellifrontipoda*-like, but in which the median ventral suture line is discernible only along part of the venter and the claws do not bear a row of ventral clawlets. As Viets states, these should be in *Frontipoda* as presently defined. Only oxids with the numerous clawlets (and these species generally have a well developed median ventral suture line along the entire length) should be retained in *Flabellifrontipoda*. With basically only the claw character one hundred percent valid for distinguishing *Frontipoda* from *Flabellifrontipoda*, Viets made the latter a subgenus of the former. Here, because *Flabellifrontipoda* has geographic continuity (all are confined to Gondwanan areas and probably are exclusively austral) as well as possessing the claw character, it is tentatively retained as a genus, but I do not feel strongly either way about its taxonomic position.

KEY TO THE NEW ZEALAND SPECIES OF FLABELLIFRONTIPODA

1. Five pairs of glandularia present in the dorsal unsclerotized strip (fig. 43); five pairs of glandularia on posterior two-thirds of body (fig. 44) *F. smithi*, new species (p. 9)
No glandularia lying in the dorsal unsclerotized strip; ten pairs of glandularia on posterior two-thirds of body (fig. 51)..... 2
2. P-III longer than P-IV and P-V combined (figs. 91, 94, 96) 3
P-III much shorter than P-IV and P-V combined (fig. 54) 5
3. P-IV fused with P-V; P-III nearly four times as long as high (fig. 94)
F. reductipalpa, new species (p. 17)
P-IV and P-V not fused; P-III proportionally much shorter and stockier, roughly two or less times as long as high 4
4. Body relatively long and narrow (fig. 90); P-II approximately twice as long as high (fig. 91); IV-Leg-5 with six or seven swimming hairs *F. ladilofa*, new species (p. 15)
Body relatively high (fig. 95); P-II much less than twice as long as high (fig. 96); IV-Leg-5 with 17-18 swimming hairs
F. crameri, new species (p. 16)

5. Setae at tip of IV-Leg-6 nearly same length as IV-Leg-5 and 6 combined; IV-Leg-5 with three or four swimming hairs 6
Setae at tip of IV-Leg-6 much less than the combined length of IV-Leg-5 and 6; seven or more swimming hairs on IV-Leg-5 7
6. Two long setae near tip of IV-Leg-6; genital acetabula placed relatively close together (figs. 51, 56)
F. hadinoma, new species (p. 10)
Three long setae near tip of IV-Leg-6; genital acetabula spaced relatively far from each other (figs. 57, 63)
F. mastigophora, new species (p. 11)
7. One of the posteroventral four pairs of coxal glandularia placed relatively far forward (fig. 82, arrow); setae at tip of IV-Leg-6 longer than that segment (fig. 85) F. zelandica Hopkins (p. 14)
None of the posteroventral four pairs of coxal glandularia placed far forward (fig. 66); setae at tip of IV-Leg-6 shorter than the segment (fig. 71) 8
8. Very large species (760 μm in length, 616 μm in height; deeply pigmented; inhabits lakes F. lacustris, new species (p. 12)
Smaller species (up to 700 μm in length, 547 μm in height); not deeply pigmented; inhabits rheophilic habitats
F. bravana, new species (p. 13)

7. Flabellifrontipoda smithi, new species

(Figs. 43-49)

Female: Length of body $623\mu\text{m}$ ($532\mu\text{m}$ - $653\mu\text{m}$); height of body $364\mu\text{m}$ ($297\mu\text{m}$ - $402\mu\text{m}$); coxae greatly expanded and occupying all of body except for a median unsclerotized strip extending from anterior end dorsally to the genital field; unsclerotized strip with paired postocularia platelets, three narrow median sclerites and five pairs of glandularia (fig. 43); posterior two-thirds of coxal area bearing only five pairs of glandularia (fig. 44). genital flaps $159\mu\text{m}$ ($133\mu\text{m}$ - $155\mu\text{m}$) in length; three pairs of genital acetabula; excretory pore on a small weakly sclerotized plate immediately posterior to genital field; median ventral suture line evident; dorsal lengths of the palpal segments: P-I, $25\mu\text{m}$ ($24\mu\text{m}$ - $26\mu\text{m}$); P-II, $30\mu\text{m}$ ($26\mu\text{m}$ - $33\mu\text{m}$); P-III, $24\mu\text{m}$ ($22\mu\text{m}$ - $24\mu\text{m}$); P-IV, $33\mu\text{m}$ ($31\mu\text{m}$ - $35\mu\text{m}$); P-V, $14\mu\text{m}$ ($12\mu\text{m}$ - $14\mu\text{m}$); ventral side of P-IV noticeably expanded and rounded; figure 49 shows the proportions and chaetotaxy of the palp; capitulum $114\mu\text{m}$ ($104\mu\text{m}$ - $126\mu\text{m}$) in length; chelicera $100\mu\text{m}$ ($97\mu\text{m}$ - $107\mu\text{m}$) in length; figure 45 illustrates a lateral view of the capitulum, chelicera and palp; dorsal lengths of the segments of the first leg: I-Leg-1, $39\mu\text{m}$ ($36\mu\text{m}$ - $40\mu\text{m}$); I-Leg-2, $35\mu\text{m}$ ($31\mu\text{m}$ - $34\mu\text{m}$); I-Leg-3, $25\mu\text{m}$ ($23\mu\text{m}$ - $26\mu\text{m}$); I-Leg-4, $55\mu\text{m}$ ($45\mu\text{m}$ - $60\mu\text{m}$); I-Leg-5, $71\mu\text{m}$ ($59\mu\text{m}$ - $76\mu\text{m}$); I-Leg-6, $85\mu\text{m}$ ($69\mu\text{m}$ - $93\mu\text{m}$); claws with numerous clawlets; figure 47 shows the proportions and chaetotaxy of the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $69\mu\text{m}$ ($59\mu\text{m}$ - $72\mu\text{m}$); IV-Leg-5, $76\mu\text{m}$ ($66\mu\text{m}$ - $89\mu\text{m}$); IV-Leg-6, $72\mu\text{m}$ ($56\mu\text{m}$ - $68\mu\text{m}$); longest seta at tip of IV-Leg-6, $90\mu\text{m}$ ($87\mu\text{m}$ - $99\mu\text{m}$) in length; figure 46 shows

IV-Leg-5 and 6.

Male: Similar to female but averaging smaller and genital flaps are proportionally much shorter; length of body $471\mu\text{m}$ ($480\mu\text{m}$ - $532\mu\text{m}$); height of body $270\mu\text{m}$ ($274\mu\text{m}$ - $304\mu\text{m}$); genital flaps $93\mu\text{m}$ ($87\mu\text{m}$ - $89\mu\text{m}$) in length; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($21\mu\text{m}$ - $24\mu\text{m}$); P-II, $26\mu\text{m}$ ($24\mu\text{m}$ - $27\mu\text{m}$); P-III, $22\mu\text{m}$ ($23\mu\text{m}$ - $24\mu\text{m}$); P-IV, $28\mu\text{m}$ ($29\mu\text{m}$ - $30\mu\text{m}$); P-V, $11\mu\text{m}$ ($10\mu\text{m}$ - $12\mu\text{m}$); capitulum $96\mu\text{m}$ ($100\mu\text{m}$ - $107\mu\text{m}$) in length; chelicera $76\mu\text{m}$ ($82\mu\text{m}$ - $84\mu\text{m}$) in length; dorsal lengths of the segments of the first leg: I-Leg-1, $36\mu\text{m}$ ($34\mu\text{m}$); I-Leg-2, $28\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); I-Leg-3, $23\mu\text{m}$ ($24\mu\text{m}$ - $25\mu\text{m}$); I-Leg-4, $40\mu\text{m}$ ($45\mu\text{m}$ - $46\mu\text{m}$); I-Leg-5, $55\mu\text{m}$ ($58\mu\text{m}$ - $60\mu\text{m}$); I-Leg-6, $72\mu\text{m}$ ($69\mu\text{m}$ - $76\mu\text{m}$); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $55\mu\text{m}$ ($55\mu\text{m}$ - $57\mu\text{m}$); IV-Leg-5, $67\mu\text{m}$ ($60\mu\text{m}$ - $63\mu\text{m}$); IV-Leg-6, $62\mu\text{m}$ ($52\mu\text{m}$ - $58\mu\text{m}$); longest seta at tip of IV-Leg-6, $72\mu\text{m}$ ($69\mu\text{m}$ - $86\mu\text{m}$) in length.

Holotype: Adult ♀, from the Shag River near its headwaters on Rt. 85, 2 km west of Pigroot Summit (Central Otago), Nov. 16, 1982.

Allotype: Adult ♂, same data as holotype.

Paratypes: NORTH ISLAND: 2 ♀, from Orauhora Stream on Rt. 30, between Barryville and Benneydale, June 6, 1981; 1 ♂, 5 ♀, from Pohue Stream at Waiomu (Coromandel Peninsula), Oct. 26, 1982; 1 ♀, tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 4 ♂, 6 ♀, from Torere River at Torere on Rt. 35 north of Opotiki, Oct. 28, 1982; 3 ♂, 2 ♀, stream 1 km north of Tohere (east of Opotiki), Oct. 29, 1982; 1 ♂, 2 ♀, from stream at Omaukoro Bridge on Rt. 2, in the "Gorge" south of Opotiki, Oct. 29, 1982; 2 ♂, 1 ♀, from Orauhora Stream on Rt. 30 between Bennydale and Barryville, Oct. 31, 1982; 1 ♀, from Otupoto Stream on Rt. 32, west of Lake Taupo, Nov. 3, 1982; SOUTH ISLAND: 1 ♀, from the Whangamoa River on Rt. 6, 3 km northeast of Whangamoa Saddle (north of Nelson), Nov. 6, 1982; 2 ♀, from Whale Creek on Rt. 6, west of Murchison, Nov. 7, 1982; 2 ♂, 7 ♀, Potters Creek on Rt. 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 1 ♀, from Boyd Creek on Rt. 94, 76 km south of Milford Sound, Nov. 14, 1982; 4 ♂, 17 ♀, same data as holotype; 1 ♀, White Rock River (southwest of Timaru), where Cliffs Road branches off Pareora Cave Road, Nov. 18, 1982; 4 ♂, 46 ♀, from the Oaro River at Oaro, on Rt. 1, approx. 20 km south of Kaikoura, Nov. 19, 1982; 2 ♂, Hope River on Rt. 6, between Glenhope and Kawatiri, Nov. 25, 1982.

Discussion: This is the only New Zealand species of *Flabellifrontipoda* with glandularia lying in the dorsal unsclerotized strip, but shares this characteristic with species from both Australia and South America. However, the present species has a proportionally less high body than these other species and P-IV is more expanded and ventrally rounded in *smithi* (fig. 49). The relationships of all the species of the genus will be discussed in a paper treating the Australian fauna.

8. Flabellifrontipoda hadinoma, new species

(Figs. 50-56)

Male: Length of body $744\mu\text{m}$ ($672\mu\text{m}$ - $744\mu\text{m}$); height of body $440\mu\text{m}$ ($411\mu\text{m}$ - $440\mu\text{m}$); coxae greatly expanded and occupying all of body except for a median unsclerotized strip extending from anterior end of body dorsally to the genital field; unsclerotized strip with paired postocularia platelets, three narrow, median sclerites and three pairs of lyrifissures (fig. 50); posterior two-thirds of coxal area bearing 10 pairs of glandularia; body gradually tapering when viewed

laterally (fig. 51); genital flaps $140\mu\text{m}$ ($122\mu\text{m}$ - $140\mu\text{m}$) in length; three pairs of acetabula; excretory pore on a small, weakly sclerotized area immediately posterior to the genital field; median ventral suture line evident; dorsal lengths of the palpal segments: P-I, $29\mu\text{m}$ ($29\mu\text{m}$ - $30\mu\text{m}$); P-II, $35\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); P-III, $35\mu\text{m}$ ($31\mu\text{m}$ - $36\mu\text{m}$); P-IV, $53\mu\text{m}$ ($50\mu\text{m}$ - $53\mu\text{m}$); P-V, $21\mu\text{m}$ ($19\mu\text{m}$ - $22\mu\text{m}$); figure 54 shows the proportions and chaetotaxy of the palp; capitulum $150\mu\text{m}$ ($148\mu\text{m}$ - $159\mu\text{m}$) in length; chelicera $137\mu\text{m}$ ($124\mu\text{m}$ - $133\mu\text{m}$) in length; figure 52 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the segments of the first leg: I-Leg-1, $48\mu\text{m}$ ($43\mu\text{m}$ - $46\mu\text{m}$); I-Leg-2, $46\mu\text{m}$ ($42\mu\text{m}$ - $45\mu\text{m}$); I-Leg-3, $48\mu\text{m}$ ($42\mu\text{m}$ - $47\mu\text{m}$); I-Leg-4, $66\mu\text{m}$ ($62\mu\text{m}$ - $65\mu\text{m}$); I-Leg-5, $86\mu\text{m}$ ($83\mu\text{m}$ - $89\mu\text{m}$); I-Leg-6, $104\mu\text{m}$ ($100\mu\text{m}$ - $104\mu\text{m}$); claws with numerous clawlets; figure 53 shows the structure of the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $93\mu\text{m}$ ($83\mu\text{m}$ - $96\mu\text{m}$); IV-Leg-5, $104\mu\text{m}$ ($93\mu\text{m}$ - $107\mu\text{m}$); IV-Leg-6, $83\mu\text{m}$ ($66\mu\text{m}$ - $83\mu\text{m}$); tip of IV-Leg-6 with two very long setae, $159\mu\text{m}$ ($149\mu\text{m}$ - $183\mu\text{m}$) in length; two or three swimming hairs present on IV-Leg-5; figure 55 shows IV-Leg-5 and 6.

Female: Similar to male but genital field is proportionally longer; length of body $745\mu\text{m}$ ($699\mu\text{m}$ - $805\mu\text{m}$); height of body $425\mu\text{m}$ ($410\mu\text{m}$ - $456\mu\text{m}$); genital flaps $174\mu\text{m}$ ($163\mu\text{m}$ - $185\mu\text{m}$) in length; dorsal lengths of the segments of the first leg: I-Leg-1, $50\mu\text{m}$ ($44\mu\text{m}$ - $49\mu\text{m}$); I-Leg-2, $45\mu\text{m}$ ($44\mu\text{m}$ - $45\mu\text{m}$); I-Leg-3, $45\mu\text{m}$ ($46\mu\text{m}$ - $48\mu\text{m}$); I-Leg-4, $67\mu\text{m}$ ($66\mu\text{m}$ - $69\mu\text{m}$); I-Leg-5, $83\mu\text{m}$ ($85\mu\text{m}$ - $87\mu\text{m}$); I-Leg-6, $79\mu\text{m}$ ($73\mu\text{m}$ - $76\mu\text{m}$); two long setae present at tip of IV-Leg-6, these $162\mu\text{m}$ - $166\mu\text{m}$ in length.

Holotype: Adult ♂, from a stream at Owhiritoa Bridge on Rt. 2, in the "Gorge" south of Opotiki, North Island, Oct. 29, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 1 ♂, from stream at Sandy's Bridge on Rt. 2, between Opotiki and Gisborne, June 3, 1981; 1 ♂, from a stream 1 km north of Tohere, on Rt. 35 east of Opotiki, Oct. 29, 1982; 11 ♂, 9 ♀, same data as holotype; 1 ♂, 5 ♀, from stream at Opato Bridge on Rt. 2, south of Opotiki, Oct. 29, 1982; 26 ♂, 22 ♀, from stream at Sandy's Bridge on Rt. 2, in "Gorge" south of Opotiki, Oct. 29, 1982; 9 ♂, 7 ♀, from stream at Gerrards Bridge on Rt. 2, in "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 1 ♀, from Graham Stream on Rt. 6, at picnic grounds 8 km northeast of Whangamoa Saddle, Nov. 6, 1982; 5 ♂, 2 ♀, from Whangamoa River on Rt. 6, 3 km northeast of Whangamoa Saddle (north of Nelson), Nov. 6, 1982; 1 ♂, 3 ♀, from a tributary of the Motupiko River on Rt. 6 between Korere and Glenhope, Nov. 7, 1982; 1 ♂, Four Mile River on Rt. 6, between Charleston and Tiromoana, Nov. 8, 1982; 5 ♂, 8 ♀, in MacLennan River at bridge on Aurora Creek Rd. (Catlins State Forest area) between Puketiro and Rt. 92, Nov. 12, 1982; 1 ♂, from Dunton Creek on Rt. 94, 85 km south of Milford Sound, Nov. 14, 1982; 11 ♂, 10 ♀, from Whangamoa River on Rt. 6, approx. 5 km northeast of Whangamoa Saddle, Nov. 23, 1982.

Discussion: The two whip-like setae on IV-Leg-6 which are nearly as long as IV-Leg-5 and 6 combined (fig. 55) are diagnostic.

9. Flabellifrontipoda mastigophora, new species

(Figs. 57-64)

Female: Length of body $449\mu\text{m}$; height of body $272\mu\text{m}$; coxae greatly expanded and occupying all of body except for a median unsclerotized strip extending from anterior end of dorsum to genital field; unsclerotized strip with

paired postocularia platelets, five short, narrow median sclerites and three pairs of lyrifissures (fig. 58); posterior two-thirds of coxal area bearing 10 pairs of glandularia (fig. 57); genital flaps $126\mu\text{m}$ in length; three pairs of genital acetabula, these small and widely separated from each other; excretory pore on a small indistinct sclerite posterior to genital field; median ventral suture line well developed; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$; P-II, $25\mu\text{m}$; P-III, $25\mu\text{m}$; P-IV, $27\mu\text{m}$; P-V, $9\mu\text{m}$; P-III noticeably expanded distally; figure 61 shows the proportions and chaetotaxy of the palp; capitulum $86\mu\text{m}$ in length; chelicera $76\mu\text{m}$ in length; capitulum and chelicera as shown for the male; dorsal lengths of the segments of the first leg: I-Leg-1, $33\mu\text{m}$; I-Leg-2, $27\mu\text{m}$; I-Leg-3, $24\mu\text{m}$; I-Leg-4, $38\mu\text{m}$; I-Leg-5, $52\mu\text{m}$; I-Leg-6, $62\mu\text{m}$; claws with numerous clawlets; figure 60 shows the proportions and chaetotaxy of the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $55\mu\text{m}$; IV-Leg-5, $69\mu\text{m}$; IV-Leg-6, $59\mu\text{m}$; IV-Leg-6 terminating in three long setae, the longest of which is $138\mu\text{m}$ in length; IV-Leg-5 with three or four long swimming hairs. figure 64 shows IV-Leg-5 and 6.

Male: Similar to female except in proportions of the genital field; length of body $456\mu\text{m}$; height of body $289\mu\text{m}$; genital flaps $79\mu\text{m}$ in length; three pairs of genital acetabula, these small and well separated from each other (fig. 63) but not to the extent found in female; dorsal lengths of the palpal segments: P-I, $22\mu\text{m}$; P-II, $27\mu\text{m}$; P-III, $28\mu\text{m}$; P-IV, $29\mu\text{m}$; P-V, $9\mu\text{m}$; capitulum $90\mu\text{m}$ in length; chelicera $80\mu\text{m}$ in length; dorsal lengths of the segments of the first leg: I-Leg-1, $32\mu\text{m}$; I-Leg-2, $25\mu\text{m}$; I-Leg-3, $24\mu\text{m}$; I-Leg-4, $41\mu\text{m}$; I-Leg-5, $58\mu\text{m}$; I-Leg-6, $68\mu\text{m}$; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $60\mu\text{m}$; IV-Leg-5, $70\mu\text{m}$; IV-Leg-6, $49\mu\text{m}$; three long setae at tip of IV-Leg-6, the longest of which is $121\mu\text{m}$.

Holotype: Adult ♀, from Waitaanga Stream near the town of the same name, on Rt. 40 west of Ohura, North Island, Oct. 31, 1982.

Allotype: Adult ♂, from Four Mile River on Rt. 6, between Charleston and Tiromoana, South Island, Nov. 8, 1982.

Discussion: The three long setae at tip of IV-Leg-6, which are approximately same length as IV-Leg-5 and 6 combined, plus the presence of widely separated acetabula, are diagnostic.

10. Flabellifrontipoda lacustris, new species

(Figs. 65-71)

Female: Length of body $760\mu\text{m}$; height of body $616\mu\text{m}$; body relatively wide, approximately $410\mu\text{m}$ in width; coxae greatly expanded and occupying all of the body except for a median strip extending from anterior end of dorsum to genital field; unsclerotized strip with paired postocularia platelets, three narrow, median sclerites and three pairs of lyrifissures (fig. 69); posterior two-thirds of coxal area bearing 10 pairs of glandularia (although epimeroglandularia 1 placed so far posteriorly that they may appear as an eleventh pair--fig. 66); genital flaps $192\mu\text{m}$ in length; three pairs of genital acetabula, these elongated and are placed close together; excretory pore on a small weak sclerite immediately posterior to genital field; median ventral suture line well developed; dorsal lengths of the palpal segments: P-I, $39\mu\text{m}$; P-II, $43\mu\text{m}$; P-III, $36\mu\text{m}$; P-IV, $59\mu\text{m}$; P-V, $19\mu\text{m}$; figure 68 shows the proportions and chaetotaxy of the palp; capitulum $149\mu\text{m}$ in length; chelicera $128\mu\text{m}$ in length; figure 70 shows a lateral view of the capitulum and chelicera; dorsal lengths of the segments of the first leg: I-Leg-1, $53\mu\text{m}$; I-Leg-2, $52\mu\text{m}$; I-Leg-3, $42\mu\text{m}$; I-Leg-4, $73\mu\text{m}$; I-Leg-5,

104 μ m; I-Leg-6, 107 μ m; claws with numerous clawlets; figure 67 illustrates the proportions and chaetotaxy of the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 145 μ m; IV-Leg-5, 193 μ m; IV-Leg-6, 183 μ m; tip of IV-Leg-6 with two elongated setae (fig. 71), these 107 μ m in length; IV-Leg-5 with 11-12 swimming hairs,

Male: Unknown.

Holotype: Adult ♀, from Lake Ianthe on Rt. 6, between Pukekura and Evans Creek, South Island, Nov. 9, 1982.

Discussion: The present species closely resembles the following species. See remarks under the latter.

11. Flabellifrontipoda bravana, new species

(Figs. 72-77, 81)

Female: Length of body 608 μ m (668 μ m-699 μ m); height of body 486 μ m (502 μ m-547 μ m); coxae greatly expanded and occupying all of body except for a median unsclerotized strip extending from anterior end of body dorsally to the genital field; unsclerotized strip with paired postocularia platelets, three narrow median sclerites and three pairs of lyrifissures (fig. 76); posterior two-thirds of coxal area bearing 10 pairs of glandularia (epimeroglandularia 1 are placed sufficiently far posteriorly as to appear as an 11th pair); body more or less rounded posteriorly when viewed laterally (fig. 73); genital flaps 167 μ m (167 μ m-228 μ m) in length; three pairs of genital acetabula, these elongated and placed close together on their respective sides; excretory pore lying on a small sclerite immediately posterior to genital field; median ventral suture line well developed; dorsal lengths of the palpal segments: P-I, 34 μ m (25 μ m-41 μ m); P-II, 42 μ m (41 μ m-45 μ m); P-III, 35 μ m (36 μ m-41 μ m); P-IV, 46 μ m (48 μ m-55 μ m); P-V, 17 μ m (16 μ m-20 μ m); palp as illustrated for male; capitulum 135 μ m (138 μ m-162 μ m) in length; dorsal lengths of the segments of the first leg: I-Leg-1, 55 μ m (52 μ m-62 μ m); I-Leg-2, 45 μ m (47 μ m-52 μ m); I-Leg-3, 36 μ m (38 μ m-45 μ m); I-Leg-4, 62 μ m (65 μ m-79 μ m); I-Leg-5, 86 μ m (91 μ m-100 μ m); I-Leg-6, 93 μ m (96 μ m-107 μ m); claws with numerous clawlets; structure of first leg is similar to that illustrated for male; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 118 μ m (123 μ m-133 μ m); IV-Leg-5, 155 μ m (168 μ m-177 μ m); IV-Leg-6, 163 μ m (163 μ m-177 μ m); two elongated setae at tip of IV-Leg-6, these 90 μ m (90 μ m-114 μ m) in length; IV-Leg-5 with 9-11 swimming hairs.

Male: Similar to female but averaging smaller and genital field proportionally shorter; length of body 608 μ m (525 μ m-653 μ m); height of body is 486 μ m (410 μ m-502 μ m); genital flaps 130 μ m (121 μ m-144 μ m) in length; dorsal lengths of the palpal segments: P-I, 33 μ m (31 μ m-39 μ m); P-II, 41 μ m (36 μ m-43 μ m); P-III, 38 μ m (31 μ m-38 μ m); P-IV, 47 μ m (45 μ m-52 μ m); P-V, 17 μ m (17 μ m-19 μ m); figure 81 shows the proportions and chaetotaxy of the palp; capitulum 131 μ m (128 μ m-148 μ m) in length; figure 74 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the segments of the first leg: I-Leg-1, 52 μ m (42 μ m-48 μ m); I-Leg-2, 48 μ m (42 μ m-48 μ m); I-Leg-3, 38 μ m (35 μ m-44 μ m); I-Leg-4, 58 μ m (62 μ m-72 μ m); I-Leg-5, 86 μ m (83 μ m-93 μ m); I-Leg-6, 90 μ m (90 μ m-97 μ m); figure 72 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 118 μ m (111 μ m-125 μ m); IV-Leg-5, 155 μ m (141 μ m-163 μ m); IV-Leg-6, 137 μ m (133 μ m-148 μ m); setae at tip of IV-Leg-6, 87 μ m (83 μ m-104 μ m) in length; 10-11 swimming hairs on IV-Leg-5; figure 75 shows IV-Leg-5 and 6.

Holotype: Adult ♀, from Pohue Stream at Waiomu (Coromandel Peninsula), Oct. 26, 1982.

Allotype: Adult ♂, same data as holotype.

Paratypes: NORTH ISLAND: 7 ♀, from Waikohatu Stream on Rt. 12 (in Kauri Forest), May 29, 1981; 1 ♂, from Otupoto Stream on Rt. 32, between Hingarae Rd. and Waihaha Rd. (west of Taupo), June 6, 1981; 4 ♀, from Mangakowiriwiri Stream on Rt. 32, at Kakako Rd. turnoff (northwest of Lake Taupo), June 6, 1981; 2 ♀, Waikohatu Stream on Rt. 12 (in Waipoua State Forest), Oct. 24, 1982; 1 ♂, 4 ♀, same data as holotype; 1 ♂, from Orauhora Stream on Rt. 30, between Barryville and Benneydale, Oct. 31, 1982; 2 ♂, 8 ♀, Waitaanga Stream near town of same name, on Rt. 40 west of Ohura, Oct. 31, 1982; 3 ♂, 3 ♀, from Mangamawhete Stream on Rt. 3, between Inglewood and Stratford (Egmont area), Nov. 1, 1982; 6 ♂, 10 ♀, from a stream on Rt. 6, just north of Makatote viaduct between Raetiki and National Park, Nov. 2, 1982; 3 ♂, 3 ♀, Makakomiko Stream on Rt. 4 (1 km south of Erua), between Erua and National Park, Nov. 2, 1982; 2 ♂, 5 ♀, from stream on Rt. 32, at Kakao Rd. turnoff (northwest of Taupo), Nov. 3, 1982; 8 ♂, 2 ♀, Otupoto Stream on Rt. 32, west of Lake Taupo, Nov. 3, 1982; SOUTH ISLAND: 1 ♂, 1 ♀, Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd., Nov. 6, 1982; 1 ♀, Potters Creek on Rt. 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 2 ♂, 6 ♀, Catlin River on Morris Saddle Rd. (in Catlin State Forest area) between Lawanui and Owaka, Nov. 12, 1982; 4 ♂, 4 ♀, from a tributary of the Tahakopa River on Tahakopa Rd., 5.5 km from Waikawa Valley Rd., Nov. 12, 1982; 2 ♂, 4 ♀, Pourakino River at Pourakino Picnic Grounds (in Longwood State Forest), on Harrington Rd. south of Otautau, Nov. 13, 1982; 4 ♀, from Boyd Creek on Rt. 94, 76 km south of Milford Sound, Nov. 14, 1982; 7 ♂, 3 ♀, from the Hope River on Rt. 6, between Glenhope and Kawatiri, Nov. 25, 1982.

Discussion: The present species resembles *F. lacustris* in most characteristics but differs as follows: The distal segments of the first leg, fourth leg and P-IV are proportionally longer in *lacustris*. *F. lacustris* is also a much more deeply pigmented species and lives in lakes rather than streams.

12. Flabellifrontipoda zelandica Hopkins

(Figs. 78-80, 82-85)

Flabellifrontipoda zelandica Hopkins, 1975. Jour. Royal Soc. New Zealand, 5: 9.

Female: Length of body 790µm-835µm; height of body 540µm-608µm; coxae greatly expanded and occupying all of body except for a median unsclerotized strip extending from anterior end of dorsum to the genital field; unsclerotized strip with paired postocularia platelets, four narrow median sclerites and three pairs of lyrifissures (fig. 83); posterior two-thirds of coxal area bearing 10 pairs of glandularia, one pair of these (fig. 82, arrow) extending anteriorly more or less in line with middle of genital field; body noticeably tapering posteriorly when viewed laterally; genital flaps 182µm-197µm in length; three pairs of genital acetabula, these elongated and placed close together on their respective sides; excretory pore on a small sclerite immediately posterior to the genital field; median ventral suture line well developed; dorsal lengths of the palpal segments; P-I, 34µm-38µm; P-II, 41µm-44µm; P-III, 39µm-41µm; P-IV, 65µm-66µm; P-V, 18µm-20µm; figure 80 shows the proportions and chaetotaxy of the palp;

capitulum $162\mu\text{m}$ - $169\mu\text{m}$ in length; figure 78 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the segments of the first leg: I-Leg-1, $55\mu\text{m}$ - $58\mu\text{m}$; I-Leg-2, $48\mu\text{m}$; I-Leg-3, $52\mu\text{m}$ - $55\mu\text{m}$; I-Leg-4, $76\mu\text{m}$ - $83\mu\text{m}$; I-Leg-5, $98\mu\text{m}$ - $104\mu\text{m}$; I-Leg-6, $100\mu\text{m}$ - $106\mu\text{m}$; claws with numerous clawlets; figure 79 shows the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $111\mu\text{m}$ - $118\mu\text{m}$; IV-Leg-5, $140\mu\text{m}$ - $141\mu\text{m}$; IV-Leg-6, $111\mu\text{m}$ - $118\mu\text{m}$; two elongated setae at tip of IV-Leg-6, these $152\mu\text{m}$ - $176\mu\text{m}$ in length; IV-Leg-5 with seven swimming hairs.

Male: Similar to female but slightly smaller and genital field proportionally shorter; length of body $760\mu\text{m}$; height of body $554\mu\text{m}$; genital flaps $152\mu\text{m}$ in length; dorsal lengths of the palpal segments: P-I, $38\mu\text{m}$; P-II, $41\mu\text{m}$; P-III, $41\mu\text{m}$; P-IV, $66\mu\text{m}$; P-V, $19\mu\text{m}$; capitulum $166\mu\text{m}$ in length; dorsal lengths of the segments of the first leg: I-Leg-1, $55\mu\text{m}$; I-Leg-2, $45\mu\text{m}$; I-Leg-3, $54\mu\text{m}$; I-Leg-4, $76\mu\text{m}$; I-Leg-5, $90\mu\text{m}$; I-Leg-6, $103\mu\text{m}$; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $110\mu\text{m}$; IV-Leg-5, $133\mu\text{m}$; IV-Leg-6, $103\mu\text{m}$; two long setae at tip of IV-Leg-6, these approximately $173\mu\text{m}$ in length; IV-Leg-5 with six swimming hairs.

Material Examined: NORTH ISLAND: 1 ♂, from Waikohatu Stream on Rt. 12 (in Kauri Forest), May 29, 1981; 1 ♀, Orauhora Stream on Rt. 30, between the towns of Barryville and Benneydale, June 6, 1981; 1 ♀, from a stream on Rt. 6, just north of Makatote Viaduct between Raetiki and National Park, Nov. 2, 1982.

Discussion: The anterior shifting of one of the lower coxal glandularia (fig. 82, arrow) is diagnostic.

13. Flabellifrontipoda ladilofa, new species

(Figs. 86-91, 93)

Male: Length of body $623\mu\text{m}$ ($669\mu\text{m}$ - $684\mu\text{m}$); height of body $395\mu\text{m}$ ($456\mu\text{m}$); coxae greatly expanded and occupying all of body except for a median unsclerotized strip extending from anterior end of dorsum to genital field; unsclerotized strip with paired postocularia platelets, three narrow median sclerites and with three pairs of lyrifissures (fig. 86); posterior two-thirds of coxal area bearing 10 pairs of glandularia; body gradually tapering posteriorly when viewed laterally (fig. 90); genital flaps $106\mu\text{m}$ ($111\mu\text{m}$) in length; three pairs of genital acetabula, these elongated and placed very close together on their respective sides; excretory pore on a small sclerite immediately posterior to the genital field; median ventral suture line well developed; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$ ($16\mu\text{m}$ - $20\mu\text{m}$); P-II, $34\mu\text{m}$ ($35\mu\text{m}$ - $37\mu\text{m}$); P-III, $38\mu\text{m}$ ($31\mu\text{m}$ - $35\mu\text{m}$); P-IV, $13\mu\text{m}$ ($13\mu\text{m}$ - $14\mu\text{m}$); P-V, $8\mu\text{m}$ ($7\mu\text{m}$); figure 91 shows the proportions and chaetotaxy of the palp; capitulum $138\mu\text{m}$ ($141\mu\text{m}$ - $145\mu\text{m}$) in length; chelicera $104\mu\text{m}$ ($114\mu\text{m}$); in length; figure 93 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the segments of the first leg: I-Leg-1, $35\mu\text{m}$ ($38\mu\text{m}$ - $40\mu\text{m}$); I-Leg-2, $38\mu\text{m}$ ($38\mu\text{m}$ - $40\mu\text{m}$); I-Leg-3, $28\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); I-Leg-4, $46\mu\text{m}$ ($46\mu\text{m}$ - $48\mu\text{m}$); I-Leg-5, $66\mu\text{m}$ ($69\mu\text{m}$ - $76\mu\text{m}$); I-Leg-6, $76\mu\text{m}$ ($79\mu\text{m}$ - $83\mu\text{m}$); claws with numerous clawlets; figure 88 shows the proportions and chaetotaxy of the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $100\mu\text{m}$ ($104\mu\text{m}$ - $107\mu\text{m}$); IV-Leg-5, $118\mu\text{m}$ ($131\mu\text{m}$); IV-Leg-6, $97\mu\text{m}$ ($107\mu\text{m}$ - $110\mu\text{m}$); two elongated setae at tip of IV-Leg-6, these $104\mu\text{m}$ - $124\mu\text{m}$ in length; IV-Leg-5 with seven swimming hairs.

Female: Similar to male but averaging somewhat larger and the genital flaps are proportionally longer; length of body $738\mu\text{m}$; height of body $502\mu\text{m}$;

genital flaps 170 μ m in length; dorsal lengths of the palpal segments: P-I, 21 μ m; P-II, 36 μ m; P-III, 36 μ m; P-IV, 14 μ m; P-V, 9 μ m; capitulum 155 μ m in length; chelicera 110 μ m in length; dorsal lengths of the segments of the first leg: I-Leg-1, 44 μ m; I-Leg-2, 41 μ m; I-Leg-3, 27 μ m; I-Leg-4, 48 μ m; I-Leg-5, 76 μ m; I-Leg-6, 83 μ m; dorsal lengths of distal segments of fourth leg: IV-Leg-4, 111 μ m; IV-Leg-5, 124 μ m; IV-Leg-6, 107 μ m; setae at tip of IV-Leg-6 broken; IV-Leg-5 with six swimming hairs.

Holotype: Adult σ , from Waikohatu Stream on Rt. 12 (in Waipoua State Forest), North Island, Oct. 24, 1982.

Allotype: Adult φ , from a stream on Rt. 6, just north of Makatote Viaduct between Raetiki and National Park, North Island, Nov. 2, 1982.

Paratypes: 2 σ , from Orauhora Stream on Rt. 30, between Barryville and Benneydale, North Island, June 6, 1981.

Discussion: This is the first of three species in which there has been a very great reduction in P-IV and P-V, and P-III has taken over the usual function of P-IV. The level of reduction of size of P-IV and P-V forms a transformation series (figs. 96, 19, 94) with P-IV and P-V actually fused in the last species. Based on structure of the palp, the present species is closest to the following species, *F. crameri* (compare figures 91 and 96). See remarks under the latter for characteristics which will separate the two.

14. Flabellifrontipoda crameri, new species

(Fig. 96)

Male: Length of body 601 μ m (653 μ m); height of body 479 μ m (486 μ m); coxae greatly expanded and occupying all of body except for a median unsclerotized strip extending from anterior end of dorsum to the genital field; unsclerotized strip with paired postocularia platelets, three narrow median sclerites and three pairs of lyrifissures; posterior two-thirds of coxal area bearing 10 pairs of glandularia; shape of body in lateral view as shown for the related species (fig. 95); genital flaps 104 μ m (111 μ m) in length; three pairs of genital acetabula, these elongated and placed very close together on their respective sides; excretory pore on a small sclerite immediately posterior to the genital field; median ventral suture line well developed; dorsal lengths of the palpal segments: P-I, 24 μ m (26 μ m); P-II, 35 μ m (36 μ m); P-III, 27 μ m (26 μ m); P-IV, 16 μ m (18 μ m); P-V, 8 μ m; figure 96 shows the proportions and chaetotaxy of the palp; capitulum 156 μ m (159 μ m) in length; chelicera 128 μ m (114 μ m) in length; capitulum and chelicera similar to that shown in figure 93; dorsal lengths of the segments of the first leg: I-Leg-1, 45 μ m (48 μ m); I-Leg-2, 44 μ m (41 μ m); I-Leg-3, 33 μ m (31 μ m); I-Leg-4, 55 μ m (55 μ m); I-Leg-5, 85 μ m (83 μ m); I-Leg-6, 86 μ m (81 μ m); claws with numerous clawlets; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 90 μ m (100 μ m); IV-Leg-5, 124 μ m (131 μ m); IV-Leg-6, 121 μ m (117 μ m); two elongated setae at tip of IV-Leg-6, these 104 μ m-107 μ m in length; IV-Leg-5 with 17-18 swimming hairs.

Female: Similar to male but genital flaps are proportionally longer; length of body 632 μ m; height of body 502 μ m; genital flaps 177 μ m in length; dorsal lengths of the palpal segments: P-I, 25 μ m; P-II, 35 μ m; P-III, 28 μ m; P-IV, 17 μ m; P-V, 9 μ m; capitulum 152 μ m in length; chelicera 121 μ m in length; dorsal lengths of the segments of the first leg: I-Leg-1, 41 μ m; I-Leg-2, 38 μ m; I-Leg-3, 27 μ m; I-Leg-4, 52 μ m; I-Leg-5, 79 μ m; I-Leg-6, 86 μ m; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 100 μ m; IV-Leg-5, 134 μ m;

IV-Leg-6, $111\mu\text{m}$; longest seta at tip of IV-Leg-6, $121\mu\text{m}$ in length; IV-Leg-5 with 17 swimming hairs.

Holotype: Adult σ , from Waikohatu Stream on Rt. 12 (in Kauri Forest), North Island, May 29, 1981.

Allotype: Adult f , same data as holotype.

Paratype: 1 σ , from Boom Stream on Rt. 25, between Hakaai and Whangamata, North Island, Oct. 27, 1982.

Discussion: As mentioned under the preceding species, *ladilofa* and *crameri* seem closely related. *F. crameri* has a high body similar to that shown in figure 95 (compare this with the lateral view of the previous species--figure 90). IV-Leg-5 bears 17-18 swimming hairs in the present species, only six or seven in the previous species. There are also distinct palpal differences (compare figures 91 and 96).

15. Flabellifrontipoda reductipalpa, new species

(Figs. 92, 94, 95, 97, 98, 100)

Female: Length of body $684\mu\text{m}$ ($669\mu\text{m}$ - $744\mu\text{m}$); height of body $514\mu\text{m}$ ($514\mu\text{m}$ - $562\mu\text{m}$); coxae greatly expanded and occupying all of body except for a medial unsclerotized strip extending from anterior end of dorsum to genital field; unsclerotized strip with paired postocularia platelets, three narrow median sclerites and three pairs of lyrifissures; posterior two-thirds of coxal area with 10 pairs of glandularia (fig. 95); genital flaps $157\mu\text{m}$ ($155\mu\text{m}$ - $177\mu\text{m}$) in length; three pairs of genital acetabula, these elongated and placed close together on their respective sides; excretory pore on a small sclerite immediately posterior to the genital field; median ventral suture line well developed; dorsal lengths of the palpal segments: P-I, $19\mu\text{m}$ ($20\mu\text{m}$ - $22\mu\text{m}$); P-II, $52\mu\text{m}$ ($51\mu\text{m}$ - $54\mu\text{m}$); P-III, $40\mu\text{m}$ ($37\mu\text{m}$ - $39\mu\text{m}$); fused P-IV and P-V, $19\mu\text{m}$ ($18\mu\text{m}$ - $21\mu\text{m}$); P-III much less high than in the previous two species and P-IV and P-V have actually fused (although area of fusion is discernible); figure 94 illustrates the proportions and chaetotaxy of the palp; capitulum $152\mu\text{m}$ ($159\mu\text{m}$ - $162\mu\text{m}$) in length; chelicera $114\mu\text{m}$ ($114\mu\text{m}$ - $121\mu\text{m}$) in length; figure 92 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the segments of the first leg: I-Leg-1, $42\mu\text{m}$ ($44\mu\text{m}$ - $48\mu\text{m}$); I-Leg-2, $44\mu\text{m}$ ($42\mu\text{m}$ - $44\mu\text{m}$); I-Leg-3, $27\mu\text{m}$ ($24\mu\text{m}$ - $29\mu\text{m}$); I-Leg-4, $51\mu\text{m}$ ($45\mu\text{m}$ - $52\mu\text{m}$); I-Leg-5, $73\mu\text{m}$ ($76\mu\text{m}$ - $79\mu\text{m}$); I-Leg-6, $83\mu\text{m}$ ($83\mu\text{m}$ - $87\mu\text{m}$); claws with numerous clawlets; I-Leg-3 with two medial setae greatly thickened; figure 97 shows the structure of the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $114\mu\text{m}$ ($114\mu\text{m}$ - $119\mu\text{m}$); IV-Leg-5, $145\mu\text{m}$ ($142\mu\text{m}$ - $155\mu\text{m}$); IV-Leg-6, $121\mu\text{m}$ ($121\mu\text{m}$ - $126\mu\text{m}$); two elongated setae at tip of IV-Leg-6, these $128\mu\text{m}$ - $138\mu\text{m}$ in length; IV-Leg-5 with 11-13 swimming hairs.

Male: Similar to female but averaging somewhat smaller and genital field proportionally shorter; length of body $654\mu\text{m}$ ($593\mu\text{m}$ - $662\mu\text{m}$); height of body $471\mu\text{m}$ ($426\mu\text{m}$ - $502\mu\text{m}$); genital flaps $106\mu\text{m}$ ($98\mu\text{m}$ - $106\mu\text{m}$) in length; dorsal lengths of the palpal segments: P-I, $20\mu\text{m}$ ($20\mu\text{m}$ - $21\mu\text{m}$); P-II, $49\mu\text{m}$ ($47\mu\text{m}$ - $51\mu\text{m}$); P-III, $36\mu\text{m}$ ($34\mu\text{m}$ - $35\mu\text{m}$); fused P-IV and P-V, $18\mu\text{m}$ ($17\mu\text{m}$ - $20\mu\text{m}$); capitulum $149\mu\text{m}$ ($145\mu\text{m}$ - $155\mu\text{m}$) in length; chelicera $107\mu\text{m}$ ($104\mu\text{m}$ - $114\mu\text{m}$) in length; dorsal lengths of the segments of the first leg: I-Leg-1, $45\mu\text{m}$ ($46\mu\text{m}$ - $48\mu\text{m}$); I-Leg-2, $43\mu\text{m}$ ($41\mu\text{m}$ - $45\mu\text{m}$); I-Leg-3, $26\mu\text{m}$ ($26\mu\text{m}$ - $28\mu\text{m}$); I-Leg-4, $48\mu\text{m}$ ($46\mu\text{m}$ - $52\mu\text{m}$); I-Leg-5, $76\mu\text{m}$ ($69\mu\text{m}$ - $75\mu\text{m}$); I-Leg-6, $85\mu\text{m}$ ($83\mu\text{m}$ - $87\mu\text{m}$); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $107\mu\text{m}$

(96 μ m-104 μ m); IV-Leg-5, 141 μ m (121 μ m-132 μ m); IV-Leg-6, 114 μ m (114 μ m-121 μ m); two elongated setae at tip of IV-Leg-6, these 104 μ m-128 μ m in length; IV-Leg-5 with 10-12 swimming hairs.

Holotype: Adult ♀, from a stream on Rt. 12 at Kaihu (Northland), North Island, May 29, 1981.

Allotype: Adult ♂, same data as holotype.

Paratypes: NORTH ISLAND: 4 ♂, 3 ♀, same data as holotype; 1 ♀, collected in Waikohatu Stream on Rt. 12 (in Kauri Forest), May 29, 1981; 1 ♂, 1 ♀, from Pohue Stream at Waiomu (Coromandel Peninsula), Oct. 26, 1982; 1 ♂, from the Tapu River, 1 km east of Tapu (Coromandel Peninsula) Oct. 27, 1982; 1 ♂, 1 ♀, from a tributary of Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 1 ♂, Orauhora Stream on Rt. 30, between Barryville and Bennydale, Oct. 31, 1982; 3 ♂, 4 ♀, from Waitaanga Stream near town of same name, on Rt. 40 west of Ohura, Oct. 31, 1982; 1 ♀, Otupoto Stream on Rt. 32, west of Lake Taupo, Nov. 3, 1982; SOUTH ISLAND: 1 ♀, from the Hope River on Rt. 6, between Glenhope and Kawatiri, Nov. 25, 1982.

Discussion: The morphology of the palp, with P-IV and P-V actually fused, and P-III much longer than high, is diagnostic for the present species.

Genus OXUS Kramer

16. Oxus sp.

(Figs. 99, 101-103)

Nymph: Body 471 μ m in length, 243 μ m in width; dorsum unsclerotized; coxal area with a median unsclerotized strip (fig. 99); provisional genital field 41 μ m in length, 38 μ m in width; dorsal lengths of the palpal segments: P-I, 21 μ m; P-II, 24 μ m; P-III, 23 μ m; P-IV, 38 μ m; P-V, 13 μ m; figure 102 illustrates the proportions and chaetotaxy of the palp; capitulum 90 μ m in length; chelicera 79 μ m in length; dorsal lengths of the segments of the first leg: I-Leg-1, 38 μ m; I-Leg-2, 28 μ m; I-Leg-3, 28 μ m; I-Leg-4, 45 μ m; I-Leg-5, 52 μ m; I-Leg-6, 60 μ m; figure 101 shows the first leg; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 59 μ m; IV-Leg-5, 79 μ m; IV-Leg-6, 86 μ m; elongated seta at tip of IV-Leg-6, 101 μ m in length; IV-Leg-5 with seven or eight swimming hairs.

Material Examined: 1 nymph, from a tributary of the Waiwawa River at the AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982.

Discussion: As it is difficult to assign a species name to a nymphal oxid, the present specimen is unnamed and it is included mainly for later comparison with Australian species of the genus. It was initially thought that only *Flabellifrontipoda*, a strictly austral group, occurred in New Zealand and, of 600 specimens of Oxidae found (including nymphs), a single nymph of *Oxus* was taken. It is possible that adults of this species occur only at other seasons of the year although, based on life histories of this genus in other parts of the world, this seems very unlikely. It is also possible that the species normally inhabits an entirely different habitat, possibly a lake or pond, and its occurrence in a stream was an accident. However, natural lentic situations apparently do not occur on the Coromandel Peninsula. A third possibility is that the mite may have arrived on its insect host from Australia. The apparent lack of species shared by New Zealand and Australia attests to the rarity with which species from one area are actually able to establish in the other. However, it seems probable that, from time to time, water mites as parasites of winged aquatic insects do survive the

trip between the two regions. However, it is very unlikely that these mites, few in number and probably widely scattered, are able to reproduce or compete with the established fauna. Both would be necessary in order to actually establish a permanent population. Once the nymphal material from my Australian collections have been put on slides, it will be possible to compare the New Zealand specimen to see if it is conspecific with one of the Australian *Oxus*. If so, this likely represents an isolated case of dispersion.

Family LIMNESIIDAE Thor

Genus LIMNESIA Koch

KEY TO THE NEW ZEALAND SPECIES OF LIMNESIA

1. Dorsal and ventral shields absent 2
Well developed dorsal and ventral shields present 3
2. Glandula Limnesiae near anterior margin of third coxae (fig. 104);
ventral side of P-IV with numerous small setal tubercles
(figs. 105, 106) L. foldoma, new species(p. 20)
Glandula Limnesiae near middle of third coxae (fig. 116); ventral
side of P-IV with only a few setal tubercles (fig. 112)
L. reptans Hopkins(p. 21)
3. Nine pairs of dorsal glandularia, these either on the dorsal shield
or in the dorsal furrow; body deeply pigmented 4
Eight pairs of dorsal glandularia, these either on the dorsal shield
or in the dorsal furrow; body lightly pigmented or pigment absent 5
4. Dorsal shield with six pairs of glandularia (fig. 120)
L. zelandica, new species(p. 21)
Dorsal shield with five pairs of glandularia (fig. 128)
L. conroyi, new species(p. 22)
5. The following five species can be distinguished by the number of
dorsal glandularia pairs incorporated into the dorsal shield and
are not presented dichotomously.
 - A. Three pairs of glandularia on dorsal shield (fig. 130)
L. auspexa, new species(p. 23)
 - B. Four pairs of glandularia on dorsal shield (fig. 140)
L. birgelda, new species (p. 24)
 - C. Six pairs of glandularia on dorsal shield (fig. 146)
L. testacea Hopkins(p. 25)
 - D. Seven pairs of glandularia on dorsal shield (fig. 150)
L. halcarda, new species(p. 26)
 - E. Eight pairs of glandularia on dorsal shield (fig. 157)
L. crowelli, new species (p. 27)

17. Limnesia foldoma, new species

(Figs. 104-110)

Male: Length of body $1150\mu\text{m}$ ($1140\mu\text{m}$ - $1215\mu\text{m}$); dorsum with a posteromedial muscle attachment platelet $125\mu\text{m}$ ($107\mu\text{m}$ - $125\mu\text{m}$) in length, $118\mu\text{m}$ ($89\mu\text{m}$ - $104\mu\text{m}$) in width; length between anterior end of first coxae and posterior end of genital field $744\mu\text{m}$ ($714\mu\text{m}$ - $805\mu\text{m}$); first coxae separated medially but close together for a relatively long distance; posterior apodemes of anterior coxal groups short; Glandula Limnesiae shifted to a spot close to anterior margin of third coxae; epimeroglandularia 1 free; genital field $273\mu\text{m}$ ($244\mu\text{m}$ - $259\mu\text{m}$) in length, $310\mu\text{m}$ ($293\mu\text{m}$ - $326\mu\text{m}$) in width; three pairs of genital acetabula, these relatively large and occupying much of the area of the genital field; only a few setae present on genital flaps; figure 104 illustrates the ventral sclerites; dorsal lengths of the palpal segments: P-I, $34\mu\text{m}$ ($30\mu\text{m}$ - $34\mu\text{m}$); P-II, $152\mu\text{m}$ ($155\mu\text{m}$ - $178\mu\text{m}$); P-III, $96\mu\text{m}$ ($96\mu\text{m}$ - $111\mu\text{m}$); P-IV, $174\mu\text{m}$ ($167\mu\text{m}$ - $181\mu\text{m}$); P-V, $68\mu\text{m}$ ($63\mu\text{m}$ - $74\mu\text{m}$); ventral side of P-II bulging and with a short, peg-like seta; P-IV with two rows of small setal tubercles giving the distal portion of ventral side a serrate appearance (fig. 106); capitulum $236\mu\text{m}$ ($222\mu\text{m}$ - $258\mu\text{m}$) in length; chelicera $407\mu\text{m}$ ($392\mu\text{m}$ - $444\mu\text{m}$) in length; figure 107 illustrates a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $199\mu\text{m}$ ($189\mu\text{m}$ - $200\mu\text{m}$); I-Leg-5, $248\mu\text{m}$ ($229\mu\text{m}$ - $244\mu\text{m}$); I-Leg-6, $219\mu\text{m}$ ($204\mu\text{m}$ - $222\mu\text{m}$); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $318\mu\text{m}$ ($303\mu\text{m}$ - $370\mu\text{m}$); IV-Leg-5, $340\mu\text{m}$ ($311\mu\text{m}$ - $326\mu\text{m}$); IV-Leg-6, $318\mu\text{m}$ ($288\mu\text{m}$ - $303\mu\text{m}$); IV-Leg-5 with 11-15 swimming hairs; IV-Leg-6 with six or seven swimming hairs; subterminal seta on IV-Leg-6 relatively short.

Female: Similar to male except in structure of palp and genital field; length of body $1290\mu\text{m}$ ($1210\mu\text{m}$ - $1520\mu\text{m}$); posteromedial platelet of dorsum $137\mu\text{m}$ ($111\mu\text{m}$ - $148\mu\text{m}$) in length, $125\mu\text{m}$ ($104\mu\text{m}$ - $118\mu\text{m}$) in width; length between tips of anterior coxae and posterior end of genital field $760\mu\text{m}$ ($684\mu\text{m}$ - $850\mu\text{m}$); genital field $303\mu\text{m}$ ($274\mu\text{m}$ - $333\mu\text{m}$) in length, $214\mu\text{m}$ ($214\mu\text{m}$ - $236\mu\text{m}$) in width; three pairs of genital acetabula, these occupying most of the area of the genital flaps (fig. 109); dorsal lengths of the palpal segments: P-I, $37\mu\text{m}$ ($30\mu\text{m}$ - $37\mu\text{m}$); P-II, $167\mu\text{m}$ ($155\mu\text{m}$ - $185\mu\text{m}$); P-III, $115\mu\text{m}$ ($104\mu\text{m}$ - $126\mu\text{m}$); P-IV, $185\mu\text{m}$ ($177\mu\text{m}$ - $214\mu\text{m}$); P-V, $85\mu\text{m}$ ($71\mu\text{m}$ - $89\mu\text{m}$); P-IV proportionally longer and with fewer ventral setal tubercles than in male (fig. 105); capitulum $251\mu\text{m}$ ($237\mu\text{m}$ - $281\mu\text{m}$) in length; chelicera $458\mu\text{m}$ ($444\mu\text{m}$ - $518\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $200\mu\text{m}$ ($192\mu\text{m}$ - $236\mu\text{m}$); I-Leg-5, $256\mu\text{m}$ ($236\mu\text{m}$ - $281\mu\text{m}$); I-Leg-6, $229\mu\text{m}$ ($214\mu\text{m}$ - $252\mu\text{m}$); figure 108 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $330\mu\text{m}$ ($296\mu\text{m}$ - $392\mu\text{m}$); IV-Leg-5, $355\mu\text{m}$ ($311\mu\text{m}$ - $407\mu\text{m}$); IV-Leg-6, $311\mu\text{m}$ ($281\mu\text{m}$ - $355\mu\text{m}$); IV-Leg-5 with 12-17 swimming hairs; IV-Leg-6 with seven or eight swimming hairs; figure 110 shows IV-Leg-5 and 6.

Holotype: Adult ♂, from the Haparapara River, 4 km north of Omaio (East Cape District), North Island, Oct. 28, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 9 ♂, 6 ♀, same data as holotype; 2 ♂, 4 ♀, from the Hope River on Rt. 6, between Glenhope and Kawatiri, South Island, Nov. 25, 1982.

Discussion: The combination of numerous small setal tubercles on P-IV, anterior shifting of the Glandula Limnesiae and presence of swimming hairs on IV-Leg-6 will easily separate the present species from all other known members of the genus.

18. Limnesia reptans Hopkins

(Figs. 111-116)

Limnesia reptans Hopkins, 1966. Trans. Royal Soc. New Zealand, 8: 1.

Male: Length of body $638\mu\text{m}$; dorsum with a posteromedial muscle attachment platelet $170\mu\text{m}$ in length, $89\mu\text{m}$ in width; postocularia on sclerites which are approximately double the size of the glandularia bases (fig. 115); length between anterior end of first coxae and posterior end of genital field $479\mu\text{m}$; first coxae separated medially but close together; posterior apodemes of anterior coxal group short; Glandula *Limnesiae* in a line with the medial setae of third coxae; epimeroglandularia 1 fused with second coxae; genital field $192\mu\text{m}$ in length, $188\mu\text{m}$ in width; three pairs of genital acetabula, these relatively small and occupying only a small portion of the surface of the genital field; numerous peripheral setae present lateral to the acetabula; figure 116 illustrates the ventral sclerites; dorsal lengths of the palpal segments: P-I, $33\mu\text{m}$; P-II, $126\mu\text{m}$; P-III, $89\mu\text{m}$; P-IV, $148\mu\text{m}$; P-V, $52\mu\text{m}$; peg-like seta on ventral side of P-II short and pointed; figure 112 shows the proportions and chaetotaxy of the palp; capitulum $170\mu\text{m}$ in length; chelicera $281\mu\text{m}$ in length; figure 111 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $111\mu\text{m}$; I-Leg-5, $137\mu\text{m}$; I-Leg-6, $148\mu\text{m}$; figure 114 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $155\mu\text{m}$; IV-Leg-5, $189\mu\text{m}$; IV-Leg-6, $185\mu\text{m}$; seta at tip of IV-Leg-6, $126\mu\text{m}$ in length; no swimming hairs present.

Female: See Hopkins (1966a).

Material Examined: This species is an inhabitant of helocrene spring seeps and was not recollected. This specimen, taken by Ceri Hopkins from the type locality (spring in valley of Mangakotukutuku River, near Paraparaumu) is here only included for the sake of completeness. Presently, only two species of *Limnesia* lacking dorsal and ventral shields are known from New Zealand, and are so distinct from each other that the characters given in the key are easily sufficient to distinguish the two.

19. Limnesia zelandica, new species

(Figs. 117-120, 122, 126)

Male: Dorsal and ventral shields present; dorsal shield $456\mu\text{m}$ in length, $330\mu\text{m}$ in width; dorsal shield bearing six pairs of glandularia and is flanked by three pairs of glandularia in the dorsal furrow; eye lenses relatively large, eye pigment present; integument pigmented; ventral shield $547\mu\text{m}$ in length, $410\mu\text{m}$ in width; capitular bay U-shaped and with a median cleft; Glandula *Limnesiae* located close to suture line between third and fourth coxae; a well developed ridge on each side extending anteriorly from openings for insertion of the fourth legs; genital field area $99\mu\text{m}$ in length, $118\mu\text{m}$ in width; three pairs of genital acetabula; gonopore $63\mu\text{m}$ in length; excretory pore and a pair of glandularia fused with ventral shield; figure 118 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$; P-II, $66\mu\text{m}$; P-III, $52\mu\text{m}$; P-IV, $86\mu\text{m}$; P-V, $40\mu\text{m}$; structure of palp as described and illustrated for the female; capitulum $192\mu\text{m}$ in length; chelicera $207\mu\text{m}$ in length; capitulum elongated and without posterodorsal projections; capitulum attached to a tube of soft

integument to form protrusible mouthparts; figure 119 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $80\mu\text{m}$; I-Leg-5, $96\mu\text{m}$; I-Leg-6, $112\mu\text{m}$; figure 122 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $91\mu\text{m}$; IV-Leg-5, $107\mu\text{m}$; IV-Leg-6, $109\mu\text{m}$; seta at tip of IV-Leg-6, $66\mu\text{m}$ in length; structure of IV-Leg-5 and 6 similar to that of the related species (fig. 123); swimming hairs absent.

Female: Similar to male except for genital field region; dorsal shield $509\mu\text{m}$ ($479\mu\text{m}$ - $547\mu\text{m}$) in length, $399\mu\text{m}$ ($380\mu\text{m}$ - $406\mu\text{m}$) in width; dorsal shield as described for male (fig. 120); ventral shield $623\mu\text{m}$ ($608\mu\text{m}$ - $658\mu\text{m}$) in length, $510\mu\text{m}$ ($479\mu\text{m}$ - $517\mu\text{m}$) in width; genital field $148\mu\text{m}$ ($141\mu\text{m}$ - $155\mu\text{m}$) in length, $137\mu\text{m}$ ($136\mu\text{m}$ - $148\mu\text{m}$) in width; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$ ($17\mu\text{m}$ - $21\mu\text{m}$); P-II, $71\mu\text{m}$ ($76\mu\text{m}$ - $78\mu\text{m}$); P-III, $52\mu\text{m}$ ($48\mu\text{m}$ - $52\mu\text{m}$); P-IV, $92\mu\text{m}$ ($93\mu\text{m}$ - $100\mu\text{m}$); P-V, $41\mu\text{m}$ ($40\mu\text{m}$ - $42\mu\text{m}$); a short, pointed peg-like seta on ventral side of P-II, figure 126 illustrates the palp; capitulum $214\mu\text{m}$ ($214\mu\text{m}$ - $229\mu\text{m}$) in length; chelicera $237\mu\text{m}$ ($229\mu\text{m}$ - $258\mu\text{m}$) in length; capitulum protrusible as described for male; dorsal lengths of the distal segments of the first leg: I-Leg-4, $83\mu\text{m}$ ($83\mu\text{m}$ - $87\mu\text{m}$); I-Leg-5, $97\mu\text{m}$ ($97\mu\text{m}$ - $100\mu\text{m}$); I-Leg-6, $111\mu\text{m}$ ($110\mu\text{m}$ - $117\mu\text{m}$); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $104\mu\text{m}$ ($106\mu\text{m}$ - $114\mu\text{m}$); IV-Leg-5, $110\mu\text{m}$ ($114\mu\text{m}$ - $121\mu\text{m}$); IV-Leg-6, $121\mu\text{m}$ ($123\mu\text{m}$ - $128\mu\text{m}$); seta at tip of IV-Leg-6, $76\mu\text{m}$ ($59\mu\text{m}$ - $85\mu\text{m}$) in length; swimming hairs absent.

Holotype: Adult ♂, from the Hope River on Route 6, between Glenhope and Kawatiri, South Island, Nov. 25, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 3 ♀, same data as holotype; 1 ♀, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), North Island, Oct. 27, 1982; 1 ♀, Kaituna River on Rt. 6, 5 km south of Havelock, South Island, Nov. 22, 1982.

Discussion: The present species is most closely related to the following species. They both are deeply pigmented and have well developed eyes and lenses. The capitulum is very long and without posterodorsal projections in both species and is attached to a tube of soft integument to form protrusible mouthparts. In addition, they have a total of nine pairs of dorsal glandularia, either incorporated into the dorsal shield or in the dorsal furrow (and only one pair of glandularia fused with the posterior portion of the ventral shield). See remarks under the following species for characters which will separate the two.

20. Limnesia conroyi, new species

(Figs. 121, 123, 125, 127, 128)

Male: Dorsal and ventral shields present; dorsal shield $517\mu\text{m}$ ($532\mu\text{m}$) in length, $395\mu\text{m}$ ($380\mu\text{m}$) in width; dorsal shield bearing five pairs of glandularia and is flanked by four additional pairs of glandularia in the dorsal furrow (fig. 128); eye lenses relatively large, eye pigment present; integument deeply pigmented; ventral shield $589\mu\text{m}$ ($601\mu\text{m}$) in length, $471\mu\text{m}$ ($456\mu\text{m}$) in width; capitular bay U-shaped and with a median cleft; Glandula Limnesiae located close to the suture line between third and fourth coxae; a well developed ridge on each side extending anteriorly from insertions of fourth legs; genital field area $100\mu\text{m}$ ($102\mu\text{m}$) in length, $122\mu\text{m}$ ($126\mu\text{m}$) in width; three pairs of genital acetabula; gonopore $78\mu\text{m}$ ($81\mu\text{m}$) in length; excretory pore and one pair of glandularia are

incorporated into the posterior end of ventral shield; figure 127 illustrates the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 19 μ m (18 μ m); P-II, 69 μ m (74 μ m); P-III, 54 μ m (55 μ m); P-IV, 93 μ m (96 μ m); P-V, 36 μ m (38 μ m); figure 125 illustrates the proportions and chaetotaxy of the palp; capitulum 207 μ m (214 μ m) in length; chelicera 229 μ m (246 μ m); in length; capitulum elongated and without posterodorsal projections; capitulum attached to a tube of soft integument to form protrusible mouthparts; structure of capitulum as shown for the related species (fig. 119); dorsal lengths of the distal segments of the first leg: I-Leg-4, 74 μ m (76 μ m); I-Leg-5, 90 μ m (90 μ m); I-Leg-6, 107 μ m (107 μ m); figure 121 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 90 μ m (92 μ m); IV-Leg-5, 102 μ m (104 μ m); IV-Leg-6, 110 μ m (111 μ m); seta at tip of IV-Leg-6, 55 μ m in length; figure 123 illustrates IV-Leg-5 and 6; swimming hairs absent.

Female: Unknown.

Holotype: Adult σ , from Waikohatu Stream on Rt. 12 (in Kauri Forest), North Island, May 29, 1981.

Paratype: 1 σ , same data as holotype.

Discussion: The present species is closely related to the preceding, *L. zelandica*, but differs in having only five pairs of glandularia (instead of six) on the dorsal shield, and the male possesses a proportionally much larger gonopore (compare figures 127, 118).

21. Limnesia auspexa, new species

(Figs. 124, 129-133)

Female: Dorsal and ventral shields present; dorsal shield 646 μ m in length, 486 μ m in width; dorsal shield bearing three pairs of glandularia and flanked by five pairs of glandularia in the dorsal furrow; eye lenses well developed; integument lightly pigmented; ventral shield 638 μ m in length, 562 μ m in width; capitular bay somewhat V-shaped and with a short median cleft; Glandula Limnesiae placed close to suture line between third and fourth coxae; no ridges extending anteriorly from openings for insertion of fourth legs; genital field 177 μ m in length, 155 μ m in width; three pairs of genital acetabula, there placed very close to the periphery; first pair of acetabula well separated from the other two pairs; the individual described here had not yet become completely sclerotized and the excretory pore and two pairs of glandularia shown free in the integument of the venter (fig. 129) without doubt would have been incorporated into the ventral shield in a fully sclerotized specimen; dorsal lengths of the palpal segments: P-I, 26 μ m; P-II, 88 μ m; P-III, 62 μ m; P-IV, 132 μ m; P-V, 42 μ m; a small peg-like seta on ventral side of P-II; figure 132 shows the proportions and chaetotaxy of the palp; capitulum 148 μ m in length; chelicera 222 μ m in length; capitulum relatively short and with well developed posterodorsal projections; mouthparts not protrusible; figure 131 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 93 μ m; I-Leg-5, 110 μ m; I-Leg-6, 125 μ m; figure 133 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 138 μ m; IV-Leg-5, 162 μ m; IV-Leg-6, 159 μ m; seta at tip of IV-Leg-6, 72 μ m in length; figure 124 shows IV-Leg-5 and 6; swimming hairs absent.

Male: Unknown.

Holotype: Newly metamorphosed φ , from the Tapu River, 1 km east of Tapu (Coromandel Peninsula), North Island, Oct. 27, 1982.

Discussion: This is the first of five species with dorsal and ventral shields in which there are a total of eight dorsal glandularia, either incorporated into the dorsal shield or free in the dorsal furrow (and there are two pairs of glandularia typically fused with the posterior portion of the ventral shield). The present species differs from the others in this group in lacking ridges extending anteriorly from the region of insertion of the fourth legs, and the body is more rounded. This species is also typically pigmented and seems to be an inhabitant of superficial waters. The other four species of the group exhibit loss of eye and integumental pigment and are members of the interstitial water assemblage. Specimens collected by Dr. Ceri Hopkins in a "swampy streamlet in the Waikanae River system, Tararua Mountains", North Island, also belong to this species.

22. Limnesia birgelda, new species

(Figs. 134-138, 140, 141)

Male: Dorsal and ventral shields present; dorsal shield $502\mu\text{m}$ ($456\mu\text{m}$ - $479\mu\text{m}$) in length, $308\mu\text{m}$ ($289\mu\text{m}$ - $334\mu\text{m}$) in width; dorsal shield bearing four pairs of glandularia and flanked by four additional pairs in the dorsal furrow (fig. 140); eye lenses reduced, eye pigment absent; integumental pigment absent, ventral shield $585\mu\text{m}$ ($540\mu\text{m}$ - $569\mu\text{m}$) in length, $380\mu\text{m}$ ($342\mu\text{m}$ - $395\mu\text{m}$) in width; capitular bay U-shaped and with a small median cleft; Glandula Limnesiae well medial to suture line between third and fourth coxae; a well developed ridge on each side extending anteriorly from insertions of fourth legs; medial margin of third coxae very long; genital field area $103\mu\text{m}$ ($96\mu\text{m}$ - $100\mu\text{m}$) in length, $126\mu\text{m}$ ($109\mu\text{m}$ - $118\mu\text{m}$) in width; three pairs of genital acetabula, anterior pair close together medially and well removed from the other pairs; gonopore $66\mu\text{m}$ ($59\mu\text{m}$ - $63\mu\text{m}$) in length and placed posteriorly on genital field; excretory pore and two pairs of glandularia incorporated into the posterior portion of the ventral shield; figure 136 shows the structure of the venter; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($19\mu\text{m}$ - $20\mu\text{m}$); P-II, $69\mu\text{m}$ ($67\mu\text{m}$ - $71\mu\text{m}$); P-III, $60\mu\text{m}$ ($54\mu\text{m}$ - $57\mu\text{m}$); P-IV, $112\mu\text{m}$ ($106\mu\text{m}$ - $109\mu\text{m}$); P-V, $32\mu\text{m}$ ($31\mu\text{m}$ - $32\mu\text{m}$); structure of palp as shown and described for female; capitulum $124\mu\text{m}$ ($111\mu\text{m}$ - $118\mu\text{m}$) in length; chelicera $199\mu\text{m}$ ($194\mu\text{m}$ - $200\mu\text{m}$) in length; capitulum with posterodorsal projections and not protrusible; dorsal lengths of the distal segments of the first leg: I-Leg-4, $78\mu\text{m}$ ($70\mu\text{m}$ - $73\mu\text{m}$); I-Leg-5, $96\mu\text{m}$ ($90\mu\text{m}$ - $93\mu\text{m}$); I-Leg-6, $114\mu\text{m}$ ($111\mu\text{m}$); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $87\mu\text{m}$ ($80\mu\text{m}$ - $83\mu\text{m}$); IV-Leg-5, $107\mu\text{m}$ ($96\mu\text{m}$ - $104\mu\text{m}$); IV-Leg-6, $114\mu\text{m}$ ($114\mu\text{m}$ - $117\mu\text{m}$); seta at tip of IV-Leg-6, $58\mu\text{m}$ ($45\mu\text{m}$ - $55\mu\text{m}$) in length; swimming hairs absent.

Female: Dorsal and ventral shields present; dorsal shield $558\mu\text{m}$ ($502\mu\text{m}$ - $532\mu\text{m}$) in length, $349\mu\text{m}$ ($304\mu\text{m}$ - $349\mu\text{m}$) in width; dorsal shield as described for male; ventral shield $638\mu\text{m}$ ($577\mu\text{m}$ - $612\mu\text{m}$) in length, $426\mu\text{m}$ ($375\mu\text{m}$ - $441\mu\text{m}$) in width; genital field extending much farther forward between the coxae and thereby greatly shortening the medial margins of the third coxae; otherwise, ventral shield much as described for male; genital field $163\mu\text{m}$ ($150\mu\text{m}$ - $155\mu\text{m}$) in length, $137\mu\text{m}$ ($122\mu\text{m}$ - $128\mu\text{m}$) in width; genital field widest anteriorly; genital acetabula small, anterior pair well separated from posterior two pairs; fig. 138 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($20\mu\text{m}$); P-II, $76\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$); P-III, $65\mu\text{m}$ ($55\mu\text{m}$ - $59\mu\text{m}$); P-IV, $123\mu\text{m}$ ($114\mu\text{m}$ - $122\mu\text{m}$); P-V, $31\mu\text{m}$ ($32\mu\text{m}$ - $33\mu\text{m}$); ventral side of P-II with a short peg-like seta which extends somewhat distally; figure 134 shows the proportions

and chaetotaxy of the palp; capilulum $130\mu\text{m}$ ($126\mu\text{m}$ - $141\mu\text{m}$) in length; chelicera $236\mu\text{m}$ ($196\mu\text{m}$ - $215\mu\text{m}$) in length; figure 141 shows a lateral view of the capitulum, chelicera and palp; capitulum not protrusible; dorsal lengths of the distal segments of the first leg: I-Leg-4, $84\mu\text{m}$ ($76\mu\text{m}$ - $82\mu\text{m}$); I-Leg-5, $102\mu\text{m}$ ($93\mu\text{m}$ - $97\mu\text{m}$); I-Leg-6, $121\mu\text{m}$ ($112\mu\text{m}$ - $116\mu\text{m}$); figure 135 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $91\mu\text{m}$ ($87\mu\text{m}$ - $90\mu\text{m}$); IV-Leg-5, $116\mu\text{m}$ ($105\mu\text{m}$ - $111\mu\text{m}$); IV-Leg-6, $128\mu\text{m}$ ($121\mu\text{m}$ - $124\mu\text{m}$); seta at tip of IV-Leg-6, $55\mu\text{m}$ ($57\mu\text{m}$ - $58\mu\text{m}$) in length; figure 137 shows IV-Leg-5 and 6; swimming hairs absent.

Holotype: Adult ♂, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula) North Island, Oct. 27, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 1 ♂, 2 ♀, same data as holotype; 1 ♀, from Boom Stream on Rt. 25 between Hakaai and Whangamata, North Island, Oct. 27, 1982; 1 ♂, 1 ♀, from a stream 1 km north of Tohere (east of Opotiki), on Rt. 35, North Island, Oct. 29, 1982.

Discussion: This is the first of four hyporheic species which have completely lost the eye pigment. The present species may be distinguished from all other New Zealand species by the four pairs of glandularia on the dorsal shield. There are also several *Limnesia* species from interstitial waters in Australia which exhibit varying degrees of development of dorsal and ventral shields and which have lost eye pigment. However, the species groups from the two areas are very distinct from each other and likely are the result of independent invasion of the hyporheic habitat.

23. *Limnesia testacea* Hopkins

(Figs. 139, 142-147)

Limnesia (Duralimnesia) testacea Hopkins, 1969. Trans. Royal Soc. New Zealand, 11: 89.

Male: Dorsal and ventral shields present; dorsal shield $460\mu\text{m}$ - $524\mu\text{m}$ in length, $291\mu\text{m}$ - $319\mu\text{m}$ in width; dorsal shield bearing six pairs of glandularia and flanked by two additional pairs in the dorsal furrow; eye lenses reduced, eye pigment absent; integumental pigment absent; ventral shield $547\mu\text{m}$ - $608\mu\text{m}$ in length, $346\mu\text{m}$ - $365\mu\text{m}$ in width; capitular bay U-shaped and with a median cleft; Glandula Limnesiae located near medial margins of coxae; a well developed ridge on each side extending anteriorly from insertions of fourth legs; medial margins of third coxae relatively short; genital field area $109\mu\text{m}$ - $111\mu\text{m}$ in width; three pairs of genital acetabula, these rather evenly spaced from each other; gonopore $74\mu\text{m}$ - $81\mu\text{m}$ in length and more or less centrally located; excretory pore and two pairs of glandularia fused with the posterior end of ventral shield; figure 144 shows the venter; dorsal lengths of the palpal segments: P-I, $15\mu\text{m}$ - $17\mu\text{m}$; P-II, $59\mu\text{m}$ - $63\mu\text{m}$; P-III, $46\mu\text{m}$ - $51\mu\text{m}$; P-IV, $88\mu\text{m}$ - $95\mu\text{m}$; P-V, $31\mu\text{m}$ - $32\mu\text{m}$; palp as described and illustrated for female; capitulum $141\mu\text{m}$ - $148\mu\text{m}$ in length; chelicera $182\mu\text{m}$ - $192\mu\text{m}$ in length; capitulum with moderately developed posterodorsal projections and capitulum slightly, if at all, protrusible; dorsal lengths of the distal segments of the first leg: I-Leg-4, $76\mu\text{m}$ - $82\mu\text{m}$; I-Leg-5, $90\mu\text{m}$ - $97\mu\text{m}$; I-Leg-6, $107\mu\text{m}$ - $111\mu\text{m}$; figure 145 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $86\mu\text{m}$ - $93\mu\text{m}$; IV-Leg-5, $104\mu\text{m}$ - $111\mu\text{m}$; IV-Leg-6, $114\mu\text{m}$ - $116\mu\text{m}$; seta at tip of IV-Leg-6, $62\mu\text{m}$ - $69\mu\text{m}$

in length; swimming hairs absent; figure 143 shows IV-Leg-5 and 6.

Female: Dorsal and ventral shields present; dorsal shield $460\mu\text{m}$ - $532\mu\text{m}$ in length, $289\mu\text{m}$ - $342\mu\text{m}$ in width; dorsal shield as described for male (fig. 146); ventral shield $540\mu\text{m}$ - $623\mu\text{m}$ in length, $349\mu\text{m}$ - $380\mu\text{m}$ in width; ventral shield, with exception of genital field region, very similar to that of male; genital field $118\mu\text{m}$ - $135\mu\text{m}$ in length, $108\mu\text{m}$ - $126\mu\text{m}$ in width; three pairs of genital acetabula, these relatively evenly spaced; genital field widest anteriorly; figure 142 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$ - $18\mu\text{m}$; P-II, $59\mu\text{m}$ - $63\mu\text{m}$; P-III, $49\mu\text{m}$ - $53\mu\text{m}$; P-IV, $87\mu\text{m}$ - $97\mu\text{m}$; P-V, $31\mu\text{m}$ - $33\mu\text{m}$; figure 147 shows the proportions and chaetotaxy of the palp; capitulum $133\mu\text{m}$ - $155\mu\text{m}$ in length; chelicera $177\mu\text{m}$ - $201\mu\text{m}$ in length; capitulum as described for male (fig. 139); dorsal lengths of the distal segments of the first leg: I-Leg-4, $71\mu\text{m}$ - $82\mu\text{m}$; I-Leg-5, $86\mu\text{m}$ - $92\mu\text{m}$; I-Leg-6, $100\mu\text{m}$ - $111\mu\text{m}$; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $83\mu\text{m}$ - $93\mu\text{m}$; IV-Leg-5, $97\mu\text{m}$ - $110\mu\text{m}$; IV-Leg-6, $104\mu\text{m}$ - $117\mu\text{m}$; seta at tip of IV-Leg-6, $65\mu\text{m}$ - $80\mu\text{m}$ in length; swimming hairs absent.

Material Examined: NORTH ISLAND: 1 ♂, from a stream at Sandy's Bridge on Rt. 2, between Opotiki and Gisborne, June 3, 1981; 2 ♂, from a stream 1 km north of Tohere (east of Opotiki on Rt. 35), Oct. 29, 1982; 2 ♀, from a stream at Owiritoa Bridge on Rt. 2, in the "Gorge" south of Opotiki, Oct. 29, 1982; 11 ♂, 6 ♀, from a stream at Opato Bridge Rest Stop, on Rt. 2 south of Opotiki, Oct. 29, 1982; 17 ♂, 4 ♀, from a stream at Sandy's Bridge on Rt. 2, in "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 5 ♀, 1 ♀, from tributary of the Wakamarina River 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 6 ♂, 1 ♀, Opouri River between Carluke and Opouri Valley, on Tennyson Inlet Rd, Nov. 6, 1982; 2 ♂, from Kararoa Creek on Rt. 6, between Barrytown and Nine Mile Village, Nov. 8, 1982; 1 ♂, from Cole Creek on Rt. 6, between Lake Moeraki and Haast, Nov. 10, 1982; 1 ♂, from Boyd Creek on Rt. 97, 76 km south of Milford Sound, Nov. 14, 1982; 1 ♀, Parawa Creek on Rt. 6, at Parawa Nokomai Station Rd (approx. 30 km south of Lake Wakatipu), Nov. 15, 1982; 26 ♂, 19 ♀, from White Rock River, southwest of Timaru, where Cliffs Rd branches off Pareora-Cave Rd, Nov. 18, 1982; 45 ♀, 34 ♀, from Rocky Gully Stream on Rt. 8, between Cave and Fairlie (west of Timaru), Nov. 18, 1982; 5 ♂, 4 ♀, Irongate Stream on Rt 1, 24 km north of Kaikoura, Nov. 21, 1982; 1 ♂, from Kaituna River on Rt 6, 5 km south of Havelock, Nov. 22, 1982; 11 ♂, 4 ♀, from Graham Stream on Rt. 6, 8 km northeast of Whangamoia Saddle, Nov. 23, 1982; 8 ♂, 3 ♀, Whangamoia River on Rt. 6, approx. 5 km northeast of Whangamoia Saddle, Nov. 23, 1982; 1 ♂, from a tributary of the Waitapu River at Paynes Ford, 3 km south of Takaka, Nov. 24, 1982; 2 ♂, 4 ♂, Pariwhakaoho River on Rt. 60, 14 km northwest of Takaka, Nov. 24, 1982.

Discussion: The only other heavily sclerotized *Limnesia* from New Zealand with six pairs of glandularia on the dorsal shield is the heavily pigmented species from superficial waters, *L. zelandica*. The present species has only two (rather than three) pairs of glandularia in the dorsal furrow and has a much shorter and relatively unprotrusible capitulum.

24. *Limnesia halcarda*, new species

(Figs. 148-151, 153)

Male: Dorsal and ventral shields present; dorsal shield $517\mu\text{m}$ ($502\mu\text{m}$) in length, $350\mu\text{m}$ ($354\mu\text{m}$) in width; dorsal shield bearing seven pairs of glandu-

laria and flanked by one pair in the dorsal furrow; eye lenses small, eye pigment absent; integumental pigment absent; figure 150 shows the morphology of the dorsal shield; ventral shield $601\mu\text{m}$ ($608\mu\text{m}$) in length, $395\mu\text{m}$ ($395\mu\text{m}$) in width; capitular bay more or less U-shaped and with a median cleft; Glandula Limnesiae located well lateral to the median coxal suture lines; medial margins of third coxae relatively long; a well developed ridge on each side extending anteriorly from region of insertion of fourth legs; genital field area $89\mu\text{m}$ ($88\mu\text{m}$) in length, $125\mu\text{m}$ ($120\mu\text{m}$) in width; three pairs of genital acetabula, anterior pair relatively close together; gonopore $52\mu\text{m}$ ($56\mu\text{m}$) in length and placed posteriorly on the genital field; figure 148 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($19\mu\text{m}$); P-II, $71\mu\text{m}$ ($68\mu\text{m}$); P-III, $52\mu\text{m}$ ($53\mu\text{m}$); P-IV, $90\mu\text{m}$ ($94\mu\text{m}$); P-V, $37\mu\text{m}$ ($39\mu\text{m}$); figure 153 shows the proportions and chaetotaxy of the palp; capitulum $170\mu\text{m}$ ($178\mu\text{m}$) in length; chelicera $214\mu\text{m}$ ($222\mu\text{m}$) in length; capitulum somewhat elongated and with small posterodorsal projections as shown for the related species (fig. 156); capitulum somewhat protrusible; dorsal lengths of the distal segments of the first leg: I-Leg-4, $77\mu\text{m}$ ($78\mu\text{m}$); I-Leg-5, $97\mu\text{m}$ ($99\mu\text{m}$); I-Leg-6, $131\mu\text{m}$ ($131\mu\text{m}$); segments of first leg relatively long and not as stocky as in other species of the group (fig. 151); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $85\mu\text{m}$ ($87\mu\text{m}$); IV-Leg-5, $88\mu\text{m}$ ($93\mu\text{m}$); IV-Leg-6, $96\mu\text{m}$ ($95\mu\text{m}$); seta at tip of IV-Leg-6, $69\mu\text{m}$ ($72\mu\text{m}$) in length; figure 149 shows the morphology of IV-Leg-5 and 6; swimming hairs absent.

Female: Unknown.

Holotype: Adult σ , from a stream at Omaukoro Bridge on Rt. 2, in the "Gorge" south of Opotiki, Oct. 29, 1982.

Paratype: 1 σ , same data as holotype.

Discussion: The presence of seven pairs of glandularia on the dorsal shield is diagnostic.

25. Limnesia crowelli, new species

(Figs. 152, 154-159)

Male: Dorsal and ventral shields present; dorsal shield $441\mu\text{m}$ ($395\mu\text{m}$ - $441\mu\text{m}$) in length, $304\mu\text{m}$ ($284\mu\text{m}$ - $312\mu\text{m}$) in width; dorsal shield bearing eight pairs of glandularia; no glandularia lying in the dorsal furrow; eye lenses small; eye pigment absent; integumental pigment absent; ventral shield $502\mu\text{m}$ ($471\mu\text{m}$ - $524\mu\text{m}$) in length, $350\mu\text{m}$ ($326\mu\text{m}$ - $342\mu\text{m}$) in width; capitular bay U-shaped and with a short median cleft; Glandula Limnesiae placed well lateral to median coxal suture lines; medial margins of third coxae relatively long; a well developed ridge on each side extending anteriorly from region of insertion of fourth legs; genital field area $85\mu\text{m}$ ($76\mu\text{m}$ - $85\mu\text{m}$) in length, $118\mu\text{m}$ ($111\mu\text{m}$ - $118\mu\text{m}$) in width; three pairs of genital acetabula; gonopore $55\mu\text{m}$ ($52\mu\text{m}$ - $55\mu\text{m}$) in length and is placed posteriorly on the genital field; figure 155 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $14\mu\text{m}$ ($14\mu\text{m}$ - $16\mu\text{m}$); P-II, $62\mu\text{m}$ ($55\mu\text{m}$ - $60\mu\text{m}$); P-III, $41\mu\text{m}$ ($43\mu\text{m}$ - $46\mu\text{m}$); P-IV, $77\mu\text{m}$ ($73\mu\text{m}$ - $77\mu\text{m}$); P-V, $33\mu\text{m}$ ($31\mu\text{m}$); structure of palp as shown for the female; capitulum $148\mu\text{m}$ ($137\mu\text{m}$ - $152\mu\text{m}$) in length; chelicera $177\mu\text{m}$ ($170\mu\text{m}$ - $177\mu\text{m}$); in length; capitulum somewhat elongated and with small posterodorsal projections; capitulum somewhat protrusible; dorsal lengths of the distal segments of the first leg: I-Leg-4, $62\mu\text{m}$ ($59\mu\text{m}$ - $61\mu\text{m}$); I-Leg-5, $79\mu\text{m}$ ($77\mu\text{m}$ - $78\mu\text{m}$); I-Leg-6, $103\mu\text{m}$ ($93\mu\text{m}$ - $100\mu\text{m}$); figure 158 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the

fourth leg: IV-Leg-4, $69\mu\text{m}$ ($64\mu\text{m}$ - $72\mu\text{m}$); IV-Leg-5, $78\mu\text{m}$ ($71\mu\text{m}$ - $78\mu\text{m}$) IV-Leg-6, $69\mu\text{m}$ ($72\mu\text{m}$ - $79\mu\text{m}$); seta at tip of IV-Leg-6, $59\mu\text{m}$ ($59\mu\text{m}$ - $65\mu\text{m}$) in length; figure 159 shows IV-Leg-5 and 6; swimming hairs absent.

Female: Dorsal and ventral shields present; dorsal shield $462\mu\text{m}$ ($449\mu\text{m}$ - $471\mu\text{m}$) in length, $349\mu\text{m}$ ($327\mu\text{m}$ - $342\mu\text{m}$) in width; dorsal shield as described for the male (fig. 157); ventral shield $547\mu\text{m}$ ($516\mu\text{m}$ - $562\mu\text{m}$) in length, $380\mu\text{m}$ ($373\mu\text{m}$ - $395\mu\text{m}$) in width; genital field extending farther forward between the coxae than in the male, thereby lessening the length of the medial coxal suture lines; otherwise, except for genital field region, structure of ventral shield as described for male; genital field $126\mu\text{m}$ ($115\mu\text{m}$ - $126\mu\text{m}$) in length, $118\mu\text{m}$ ($118\mu\text{m}$ - $129\mu\text{m}$) in width; three pairs of genital acetabula, these relatively evenly spaced; genital field widest anteriorly; figure 154 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $14\mu\text{m}$ ($14\mu\text{m}$ - $17\mu\text{m}$); P-II, $63\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); P-III, $47\mu\text{m}$ ($48\mu\text{m}$ - $51\mu\text{m}$); P-IV, $84\mu\text{m}$ ($83\mu\text{m}$ - $88\mu\text{m}$); P-V, $35\mu\text{m}$ ($34\mu\text{m}$ - $38\mu\text{m}$); ventral side of P-II with a short peg-like seta; figure 152 illustrates the proportions and chaetotaxy of the palp; capitulum $148\mu\text{m}$ ($159\mu\text{m}$ - $163\mu\text{m}$) in length; chelicera $185\mu\text{m}$ ($177\mu\text{m}$ - $192\mu\text{m}$) in length; figure 156 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $66\mu\text{m}$ ($59\mu\text{m}$ - $69\mu\text{m}$); I-Leg-5, $80\mu\text{m}$ ($80\mu\text{m}$ - $83\mu\text{m}$); I-Leg-6, $100\mu\text{m}$ ($104\mu\text{m}$); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $73\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$); IV-Leg-5, $79\mu\text{m}$ ($78\mu\text{m}$ - $82\mu\text{m}$); IV-Leg-6, $83\mu\text{m}$ ($80\mu\text{m}$ - $82\mu\text{m}$); seta at tip of IV-Leg-6, $62\mu\text{m}$ ($72\mu\text{m}$ - $83\mu\text{m}$) in length; no swimming hairs present.

Holotype: Adult ♂, from a stream at Omaukoro Bridge on Rt. 2, in the "Gorge" south of Opotiki, North Island, Oct. 29, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 1 ♀, from a stream on Wainui Rd, 5 km west of Mahinepua Rd (northern North Island), Oct. 22, 1982; 1 ♂, 1 ♀, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 1 ♀, from a stream at Owhiritoa Bridge on Rt. 2, in the "Gorge" south of Opotiki, Oct. 29, 1982; 1 ♂, 1 ♀, same data as holotype; SOUTH ISLAND: 1 ♂, from the Whangamoa River on Rt. 6, 3 km northeast of the Whangamoa Saddle, Nov. 6, 1982; 1 ♂, White Rock River, southeast of Timaru, where Cliffs Rd branches from Pareora-Cave Rd, Nov. 18, 1982; 1 ♀, Kaituna River on Rt. 6, 5 km south of Havelock, Nov. 22, 1982; 3 ♂, from a tributary of the Waitapu River at Paynes Ford, 3 km south of Takaka, Nov. 24, 1982.

Discussion: The eight pairs of glandularia incorporated into the dorsal shield are diagnostic.

Family HYGROBATIDAE Koch

Genus AUSTRALIOBATES Lundblad

Discussion: With the collection of four species of *Australiobates* in New Zealand, the genus becomes the first strictly austral group to be taken in four Gondwanan regions: Australia, South America, South Africa and New Zealand. The mites from New Zealand belong to a distinctive species group characterized by a great increase in both the number and length of the dorsal setae on P-III (and often on P-II) in males, and to a lesser degree in the females. This character state is synapomorphic for the New Zealand species of the genus. Also, when compared to other members of the typical subgenus, they have a relatively wide posterior capitular projection (figs. 160, 165). This projection is very similar

to that found in the subgenus *Coaustraliobates* but, with this exception, the New Zealand species fit well into the typical subgenus.

KEY TO THE NEW ZEALAND SPECIES OF AUSTRALIOBATES

1. IV-Leg-5 with eight to ten flexible swimming hairs, these spaced out over distal half of segment *A. solomis*, new species (p. 29)
- IV-Leg-5 with one to four stiff swimming hairs, these placed near distal end of segment 2

REMAINDER OF KEY BASED ON MALES ONLY

2. Males with very long setae on dorsal side of P-II as well as on P-III (figs. 169, 174) 3
- Males without long setae on dorsal side of P-II (fig. 161)
A. vietsi, new species .(p. 32)
3. Small species (729 μ m-760 μ m in length); gonopore much wider than diameter of an acetabulum (fig. 173); long dorsal setae of P-III not originating from proximal portion of segment (fig. 174)
A. savanus, new species .(p. 30)
- Larger species (910 μ m-1060 μ m in length); gonopore approximately same width as an acetabulum (fig. 168); long setae on dorsal side of P-III originating along entire length of segment (fig. 169)
A. setipalpis, new species ..(p. 31)

26. *Australiobates vietsi*, new species

(Figs. 160-164)

Male: Length of body 850 μ m (760 μ m-940 μ m); length between tips of first coxae and posterior end of genital field 755 μ m (700 μ m-760 μ m); coxae pigmented; first coxae separated medially; capitulum with a long posterior projection which is moderately wide and slightly tapering; capitulum with its projection 319 μ m in length; short projections present at posterior margins of fourth coxae; apodemes extending anteriorly from these projections to the glands of the fourth coxae; genital field subterminal and too foreshortened for accurate length measurements; primary sclerites of genital field 211 μ m (190 μ m-196 μ m) in width; the width including secondary sclerotization 236 μ m (196 μ m-205 μ m); gonopore 52 μ m (56 μ m) in width; three pairs of genital acetabula; figure 163 shows the structure of the venter; dorsum soft and without dorsalia; dorsal lengths of the palpal segments: P-I, 33 μ m (33 μ m-35 μ m); P-II, 121 μ m (117 μ m-121 μ m); P-III, 117 μ m (112 μ m-114 μ m); P-IV, 171 μ m (169 μ m-175 μ m); P-V, 64 μ m (59 μ m-61 μ m); dorsodistal half of P-III with approximately 10 somewhat elongated setae; figure 161 shows the proportions and chaetotaxy of the palp; chelicera 325 μ m-340 μ m in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 242 μ m (248 μ m-251 μ m); I-Leg-5, 268 μ m (259 μ m-282 μ m); I-Leg-6, 248 μ m (251 μ m-259 μ m); first leg similar to that shown for the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 318 μ m (311 μ m-318 μ m); IV-Leg-5, 348 μ m (340 μ m-355 μ m); IV-Leg-6, 355 μ m (359 μ m-362 μ m); end of IV-Leg-4 with two or three stiff swimming hairs; end of IV-Leg-5 with three or four stiff swim-

ming hairs.

Female: Length of body $1290\mu\text{m}$ ($760\mu\text{m}$); length between anterior end of first coxae and posterior end of genital field $927\mu\text{m}$ ($714\mu\text{m}$ - $730\mu\text{m}$); coxal area rather similar to that of male although the coxal groups tend to be more separated from each other; capitulum and its posterior projection $358\mu\text{m}$ in length; genital field $269\mu\text{m}$ ($222\mu\text{m}$) in width; three pairs of acetabula; figure 160 shows the structure of the venter; dorsum soft and without dorsalia; dorsal lengths of the palpal segments: P-I, $42\mu\text{m}$ ($40\mu\text{m}$ - $42\mu\text{m}$); P-II, $131\mu\text{m}$ ($138\mu\text{m}$ - $143\mu\text{m}$); P-III, $116\mu\text{m}$ ($121\mu\text{m}$ - $128\mu\text{m}$); P-IV, $185\mu\text{m}$ ($186\mu\text{m}$ - $201\mu\text{m}$); P-V, $66\mu\text{m}$ ($69\mu\text{m}$ - $72\mu\text{m}$); female lacking the patch of distodorsal elongated setae on P-III found in the male (fig. 164); dorsal lengths of the distal segments of the first leg: I-Leg-4, $259\mu\text{m}$ ($263\mu\text{m}$ - $281\mu\text{m}$); I-Leg-5, $278\mu\text{m}$ ($278\mu\text{m}$ - $296\mu\text{m}$); I-Leg-6, $248\mu\text{m}$ ($259\mu\text{m}$ - $270\mu\text{m}$); figure 162 shows the morphology of these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $333\mu\text{m}$ ($333\mu\text{m}$ - $355\mu\text{m}$); IV-Leg-5, $363\mu\text{m}$ ($348\mu\text{m}$ - $392\mu\text{m}$); IV-Leg-6, $359\mu\text{m}$ ($355\mu\text{m}$ - $389\mu\text{m}$); end of IV-Leg-4 with two or three stiff swimming hairs; end of IV-Leg-5 with three or four stiff swimming hairs.

Holotype: Adult ♂, from Mangamawhete Stream on Rt 3, between Inglewood and Stratford (Egmont area), North Island, Nov. 1, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 1 ♂, 1 ♀, tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 1 ♂, 1 ♀, same data as holotype.

Discussion: The present species differs from the other three New Zealand species in its simpler chaetotaxy of the palp. Males have a distal patch of about 10 somewhat elongated setae on the dorsal side of P-III but the female lacks the elongated setae on the palp. The pigmentation of the coxae is much darker in the present species and the structure and numbers of swimming hairs on the fourth leg are diagnostic (two or three stiff swimming hairs on IV-Leg-4, three or four stiff swimming hairs on IV-Leg-5).

27. Australiobates savanus, new species

(Figs. 172-174)

Male: Length of body $729\mu\text{m}$ ($760\mu\text{m}$); length between anterior end of first coxae and posterior end of genital field $668\mu\text{m}$ ($684\mu\text{m}$); coxae a light brownish color; first coxae separated medially; capitulum with a long posterior projection which is moderately wide and noticeably tapering posteriorly; capitulum with its projection $258\mu\text{m}$ ($289\mu\text{m}$) in length; short projections present at posterior end of fourth coxae, apodemes extending anteriorly from this projection to the glands of the fourth coxae; genital field subterminal and too foreshortened for accurate length measurements; genital field $148\mu\text{m}$ ($177\mu\text{m}$) in width; gonopore $52\mu\text{m}$ in width; typically with three pairs of genital acetabula, but one is missing on one side in one of the two known specimens; figure 173 shows the structure of the venter; dorsum soft and without dorsalia; dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$ ($35\mu\text{m}$); P-II, $88\mu\text{m}$ ($96\mu\text{m}$); P-III, $86\mu\text{m}$ ($97\mu\text{m}$); P-IV, $124\mu\text{m}$ ($138\mu\text{m}$); P-V, $52\mu\text{m}$ ($59\mu\text{m}$); dorsodistal portion of P-II with four very long setae; dorsodistal portion of P-III with approximately eight very long setae; figure 174 shows the structure of the palp; chelicera $288\mu\text{m}$ ($310\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $182\mu\text{m}$ ($207\mu\text{m}$); I-Leg-5, $196\mu\text{m}$ ($229\mu\text{m}$); I-Leg-6, $185\mu\text{m}$ ($222\mu\text{m}$); figure 172 illus-

trates the proportions and chaetotaxy of these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $258\mu\text{m}$ ($303\mu\text{m}$); IV-Leg-5, $289\mu\text{m}$ ($333\mu\text{m}$); IV-Leg-6, $278\mu\text{m}$ ($310\mu\text{m}$); end of IV-Leg-4 with one stiff swimming hair; end of IV-Leg-5 with two stiff swimming hairs.

Female: Unknown.

Holotype: Adult ♂, from Waitaanga Stream near the town of the same name, on Rt 40 west of Ohura, North Island, Oct. 31, 1982.

Paratype: 1 ♂, same data as holotype.

Discussion: This is a much smaller species than the other three New Zealand members of the genus. It differs from the previous species in having four long setae on dorsodistal portion of P-II and, although there are roughly the same number of long setae on P-III in the two species, those of the present species are much longer (compare figures 174, 161).

28. Australiobates setipalpis, new species

(Figs. 165-169)

Male: Length of body $990\mu\text{m}$ ($910\mu\text{m}$ - $1060\mu\text{m}$); length between tips of first coxae and posterior end of genital field $927\mu\text{m}$ ($866\mu\text{m}$ - $958\mu\text{m}$); coxae a light brown in color; first coxae separated medially; capitulum with a long posterior projection which is moderately wide; capitulum and its projection $289\mu\text{m}$ in length; short projections at posterior end of fourth coxae; apodemes extending anteriorly from these projections to the glands of the fourth coxae; genital field subterminal and too foreshortened for accurate length measurements; genital field $200\mu\text{m}$ ($199\mu\text{m}$ - $207\mu\text{m}$) in width; gonopore $64\mu\text{m}$ ($53\mu\text{m}$ - $67\mu\text{m}$) in width; figure 168 shows the structure of the venter; dorsum soft and without dorsalia; dorsal lengths of the palpal segments: P-I, $40\mu\text{m}$ ($35\mu\text{m}$ - $41\mu\text{m}$); P-II, $135\mu\text{m}$ ($117\mu\text{m}$ - $138\mu\text{m}$); P-III, $121\mu\text{m}$ ($114\mu\text{m}$ - $128\mu\text{m}$); P-IV, $190\mu\text{m}$ ($166\mu\text{m}$ - $197\mu\text{m}$); P-V, $69\mu\text{m}$ ($66\mu\text{m}$ - $70\mu\text{m}$); dorsodistal portion of P-II with six or seven very long setae; entire dorsal side of P-III with numerous very long setae; figure 169 shows these unusual setae; chelicera $199\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $244\mu\text{m}$ ($259\mu\text{m}$ - $310\mu\text{m}$); I-Leg-5, $303\mu\text{m}$ ($281\mu\text{m}$ - $340\mu\text{m}$); I-Leg-6, $259\mu\text{m}$ ($266\mu\text{m}$ - $303\mu\text{m}$); first leg similar to that shown for the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $418\mu\text{m}$ ($358\mu\text{m}$ - $434\mu\text{m}$); IV-Leg-5, $471\mu\text{m}$ ($403\mu\text{m}$ - $486\mu\text{m}$); IV-Leg-6, $471\mu\text{m}$ ($410\mu\text{m}$ - $486\mu\text{m}$); end of IV-Leg-4 with one stiff swimming hair; end of IV-Leg-5 with two stiff swimming hairs; dorsal side of I-Leg-2 and 3 with numerous relatively long, fine setae; II-Leg-3 and III-Leg-3 also bearing this same type of setae.

Female: Length of body $1370\mu\text{m}$ ($1100\mu\text{m}$ - $1520\mu\text{m}$); length between anterior end of first coxae and posterior end of genital field $1065\mu\text{m}$ ($910\mu\text{m}$ - $1150\mu\text{m}$); the coxal area rather similar to that of male except that the coxal groups tend to be more widely separated from each other; capitulum with its projection $434\mu\text{m}$ in length; genital field $259\mu\text{m}$ ($244\mu\text{m}$ - $266\mu\text{m}$) in width; length between anterior end of pregenital sclerite and posterior end of postgenital scletite $244\mu\text{m}$ ($222\mu\text{m}$ - $252\mu\text{m}$); three pairs of genital acetabula; figure 165 shows the structure of the venter; dorsum soft and without dorsalia; dorsal lengths of the palpal segments: P-I, $43\mu\text{m}$ ($37\mu\text{m}$ - $45\mu\text{m}$); P-II, $138\mu\text{m}$ ($128\mu\text{m}$ - $140\mu\text{m}$); P-III, $128\mu\text{m}$ ($121\mu\text{m}$ - $126\mu\text{m}$); P-IV, $197\mu\text{m}$ ($180\mu\text{m}$ - $201\mu\text{m}$); P-V, $76\mu\text{m}$ ($63\mu\text{m}$ - $73\mu\text{m}$); female lacking the dense grouping of long setae on P-II and P-III but with scattered setae of moderate length in the same areas (fig. 166); chelicera $218\mu\text{m}$ ($199\mu\text{m}$ - $226\mu\text{m}$)

in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $288\mu\text{m}$ ($266\mu\text{m}$ - $284\mu\text{m}$); I-Leg-5, $316\mu\text{m}$ ($293\mu\text{m}$ - $308\mu\text{m}$); I-Leg-6, $281\mu\text{m}$ ($263\mu\text{m}$ - $278\mu\text{m}$); figure 167 shows these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $403\mu\text{m}$ ($380\mu\text{m}$ - $395\mu\text{m}$); IV-Leg-5, $439\mu\text{m}$ ($414\mu\text{m}$ - $441\mu\text{m}$); IV-Leg-6, $418\mu\text{m}$ ($380\mu\text{m}$ - $405\mu\text{m}$); end of IV-Leg-4 with one stiff swimming hair; end of IV-Leg-5 with two stiff swimming hairs.

Holotype: Adult ♂, from Pohue Stream at Waiomu (Coromandel Peninsula), North Island, Oct. 26, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 4 ♂, 3 ♀, same data as holotype; 1 ♂, 1 ♀, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 3 ♂, Waitaanga Stream near town of same name, on Rt. 40 west of Ohura, Oct. 31, 1982; 2 ♂, 1 ♀, from stream on Rt 32, at Kakao Rd turnoff (northwest of Taupo), Nov. 3, 1982; 1 ♂, 3 ♀, Opupoto Stream on Rt 32, west of Lake Taupo, Nov. 3, 1982; SOUTH ISLAND: 1 ♂, Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, Nov. 6, 1982; 1 ♀, in the Wind Bag River on Rt 6, between Lake Paringa and Lake Moeraki (north of Haast), Nov. 10, 1982; 7 ♂, 6 ♀, Catlin River on Morris Saddle Rd (in Catlin State Forest area), between Lawanui and Owaka, Nov. 12, 1982; 15 ♂, 6 ♀, from the MacLennan River at bridge on Aurora Creek Rd (Catlin State Forest area) between Puketiro and Rt 92, Nov. 12, 1982; 6 ♂, 6 ♀, from a tributary of the Tahakopa River on Tahakopa Rd, 5.5 km from Waikawa Valley rd, Nov. 21, 1982; 4 ♂, 4 ♀, Pourakino River at Pourakino Picnic Grounds (Longwood State Forest) on Harrington Rd south of Otautau, Nov. 13, 1982; 1 ♂, small creek on Rt 6, approximately 10 km west of Havelock, Nov. 22, 1982.

Discussion: Males of this species exhibit the greatest development of long setae on P-II and P-III (fig. 169). The female bears fewer and shorter setae in these positions but do have more (four) setae of moderate length on the dorso-distal portion of P-II than in any other known female of the genus. The number of swimming hairs (two stiff setae on IV-Leg-4 and one stiff seta on IV-Leg-5) is also characteristic of the previous species, in which the female is unknown. However, the latter is a much smaller species and it is likely the posterior projection of the capitulum will be more tapering than in the present species (compare figures 165, 173).

29. Australiobates solomis, new species

(Figs. 170, 171)

Female: Length of body $1400\mu\text{m}$ ($1140\mu\text{m}$ - $1220\mu\text{m}$); length between anterior tips of first coxae and posterior end of genital field $1095\mu\text{m}$ ($965\mu\text{m}$ - $1060\mu\text{m}$); coxae a light brown color; first coxae separated medially; capitulum with a long posterior projection which is moderately wide and gradually tapers posteriorly; capitulum with its projection $410\mu\text{m}$ in length; short projections at posterior end of fourth coxae; apodemes extending anteriorly from these projections to the glands of the fourth coxae; genital field $281\mu\text{m}$ ($259\mu\text{m}$ - $274\mu\text{m}$) in width; length between anterior end of pregenital sclerite and posterior end of postgenital sclerite $244\mu\text{m}$ ($244\mu\text{m}$ - $258\mu\text{m}$); figure 170 shows the structure of the venter; dorsum soft and without dorsalia; dorsal lengths of the palpal segments: P-I, $46\mu\text{m}$ ($42\mu\text{m}$ - $48\mu\text{m}$); P-II, $145\mu\text{m}$ ($138\mu\text{m}$ - $155\mu\text{m}$); P-III, $131\mu\text{m}$ ($118\mu\text{m}$ - $138\mu\text{m}$); P-IV, $211\mu\text{m}$ ($190\mu\text{m}$ - $231\mu\text{m}$); P-V, $69\mu\text{m}$ ($69\mu\text{m}$ - $80\mu\text{m}$); P-III with a dorsodistal patch of moderately long setae (fig. 171); chelicera $203\mu\text{m}$ ($227\mu\text{m}$ - $236\mu\text{m}$) in length;

dorsal lengths of the distal segments of the first leg: I-Leg-4, $307\mu\text{m}$ ($259\mu\text{m}$ - $347\mu\text{m}$); I-Leg-5, $340\mu\text{m}$ ($259\mu\text{m}$ - $347\mu\text{m}$); I-Leg-6, $288\mu\text{m}$ ($245\mu\text{m}$ - $310\mu\text{m}$); dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $440\mu\text{m}$ ($334\mu\text{m}$ - $410\mu\text{m}$); IV-Leg-5, $471\mu\text{m}$ ($364\mu\text{m}$ - $440\mu\text{m}$); IV-Leg-6, $456\mu\text{m}$ ($350\mu\text{m}$ - $433\mu\text{m}$); IV-Leg-4 with five to seven flexible swimming hairs; IV-Leg-5 with eight to ten flexible swimming hairs; these swimming hairs extending over distal half of segments; the second and third legs also with many swimming hairs in the same positions.

Male: Unknown.

Holotype: Adult ♀, from the Wind Bag River on Rt 6, between Lake Paringa and Lake Moeraki (north of Haast), South Island, Nov. 10, 1982.

Paratypes: NORTH ISLAND: 1 ♀, from Pohue Stream at Waiomu (Coromandel Peninsula), Oct. 26, 1982; 3 ♀, from the Kotare "River" on Rt 30, Oct. 31, 1982; SOUTH ISLAND: 1 ♀, same data as holotype; 1 ♀, from Cole Creek on Rt. 6, between Lake Moeraki and Haast, Nov. 10, 1982.

Discussion: Since the male is unknown, the development of the dorsal setae on P-II and P-III cannot be compared with the other three species. However, a patch of moderately long setae on P-III of the female suggests the male will have numerous setae on both P-II and P-III. The diagnostic characteristic of the present species is the numerous thin, flexible swimming hairs on the fourth and fifth segments of the second, third and fourth legs.

Genus NOTOHYGROBATES, new genus

Diagnosis: Dorsum with a large anterior plate bearing the postocularia, two pairs of smaller dorsalia and a pair of greatly enlarged glandularia (fig. 182); first coxae separated; capitulum with a long, very narrow posterior projection; some muscle scarring present but no distinct apodemes extending from posterior projections of fourth coxae to the glands of the fourth coxae; three pairs of genital acetabula; gonopore and acetabula small and occupying only a small portion of the genital field; palp with papillae-bearing ventral bulges on P-II and P-III, and a peg-like seta near middle of ventral side of P-IV; swimming hairs absent.

Type Species: *Notohygrobates kathrynae*, new species

Discussion: The new genus exhibits a mixture of character states used to define several austral South American genera and I am presently uncertain as to its affinities. It is expected that a later study of new material from Chile will permit a more exact placement of the new genus within the system. For the present, however, the combination of separated first coxae and long projection on the capitulum plus the structure of the palp (papillate ventral projections on P-II and P-III; peg-like seta near middle of ventral side of P-IV) will easily separate the new genus from all other known hygrobatids.

30. *Notohygrobates kathrynae*, new species

(Figs. 181-185)

Male: Both integumental and eye pigment absent; body $486\mu\text{m}$ in length; the first coxae separated medially; capitulum with a long, narrow posterior projection; total length of capitulum and its projection $228\mu\text{m}$; posterior margins of fourth coxae extending posterolaterally and with short posterior projections; muscle attachment scars forming a rather ill defined apodeme which extends a short distance forward on the fourth coxae but not nearly to the glands of the

fourth coxae; genital field $129\mu\text{m}$ in length, $133\mu\text{m}$ in width; three pairs of genital acetabula, these small and occupying only a small area of the genital field; gonopore small, $27\mu\text{m}$ in length; small sclerites flanking the genital field laterally; excretory pore lying free in the integument immediately posterior to the genital field; figure 181 shows a ventral view; dorsum with an anteromedial plate $133\mu\text{m}$ in length, $185\mu\text{m}$ in width; this plate bearing the postocularia; two pairs of small dorsalia also present; posterolateral portion of dorsum with a pair of greatly enlarged glandularia tubercles; arrangement of the other dorsal glandularia better illustrated (fig. 182) than described; dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$; P-II, $82\mu\text{m}$; P-III, $72\mu\text{m}$; P-IV, $104\mu\text{m}$; P-V, $34\mu\text{m}$; ventral side of P-II and P-III bulging and with numerous, small papillae; ventral side of P-IV with a short peg-like seta; figure 185 shows the proportions and chaetotaxy of the palp; chelicera $170\mu\text{m}$ in length (fig. 183); dorsal lengths of the distal segments of the first leg: I-Leg-4, $111\mu\text{m}$; I-Leg-5, $109\mu\text{m}$; I-Leg-6, $117\mu\text{m}$; figure 184 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $148\mu\text{m}$; IV-Leg-5, $159\mu\text{m}$; IV-Leg-6, $163\mu\text{m}$; swimming hairs absent.

Female: Unknown.

Holotype: Adult ♂, from a stream 1 km north of Tohere (east of Opotiki on Rt. 35), North Island, Oct. 29, 1982.

Discussion: The characters given in the generic diagnosis will easily separate the present species from all other known hygrobatids.

Genus HOPKINSOBATES, new genus

Diagnosis: Dorsal and ventral shields present; dorsal shield consisting of a large anterior plate and smaller posterior plate which are very slightly fused; anterior plate bearing the postocularia and two pairs of setae (actually glandularia in which the gland portion has disappeared); posterior plate bearing two pairs of glandularia, of which the most posterior are greatly enlarged; posterior plate also with three pairs of setae which likely mark the sites of additional glandularia in which the gland portion has disappeared (fig. 175); ventral shield entire and incorporating the genital field; first three pairs of coxae placed well anterior on the ventral shield; median suture lines of second, third and fourth coxae evident; glands of the fourth coxae extending far forward, producing an S-shaped suture line between the third and fourth coxae (fig. 177); coxal projections present at insertions of fourth legs; three pairs of genital acetabula, these placed posterior to the gonopore; sexual dimorphism largely confined to the size of the gonopore; excretory pore incorporated into the ventral shield; palp with a heavy, curved seta on medial side of P-III; capitulum with a very long anchoral process.

Type Species: *Hopkinsobates suzannae*, new species.

Discussion: *Hopkinsobates* shares some character states with an undescribed genus from Australia but seems closest to the New World genus *Diamphidaxona*. *Hopkinsobates* and *Diamphidaxona* both have divided dorsal shields, but the anterior plate is much smaller than the posterior plate in the latter genus. Both share a similar reduction in the gland portion of the dorsal glandularia. The anterior plate of both genera bear the postocularia and two pairs of setae (glandularia homologs), but the preocularia are incorporated into the plate in *Diamphidaxona*, free in the dorsal furrow of the New Zealand genus. The posterior plate bears enlarged glandularia in both genera as well as several pairs of setae which are likely glandularia homologs. Similarities of the ventral shield include the

unusual anterior shifting of the glands of the fourth coxae (fig. 177) which is almost certainly synapomorphic. A somewhat similar shifting of the glands of the fourth coxae has occurred in *Hygrobatides*, a subgenus of *Hygrobates*. However, other than both being hygrobatids, the two groups are not closely related and the shifting of the glands has occurred independently from a "typical" straight suture line in each line of evolution. Other similarities between *Hopkinsobates* and *Diamphidaxona*, which may or may not be shared apomorphisms, are the far anterior placement of the first three pairs of coxae and the well developed projections associated with insertions of the fourth legs which extend noticeably anterolaterally. Major differences in the ventral shield are a median coxal suture line present and genital field fused with the ventral shield in the New Zealand genus. The legs, capitulum with its long anchoral process, and palp are also very similar in the two genera.

31. Hopkinsobates suzannae, new species

(Figs. 175-180)

Male: Dorsal and ventral shields present; integument colorless; eye pigment reduced in size; dorsal shield $365\mu\text{m}$ ($362\mu\text{m}$) in length, $228\mu\text{m}$ ($217\mu\text{m}$) in width; dorsal shield divided; posterior plate $61\mu\text{m}$ ($60\mu\text{m}$) in length; anterior and posterior plates slightly fused but suture lines well developed; anterior plate bearing the postocularia and two pairs of setae (homologs of glandularia); posterior plate with a pair of "normal" glandularia near the suture line between the two plates and enlarged glandularia posteriorly; three pairs of setae (likely representing homologs of glandularia) also on the posterior plate; structure of dorsal shield as illustrated for the female; ventral shield $388\mu\text{m}$ ($399\mu\text{m}$) in length, $243\mu\text{m}$ ($239\mu\text{m}$) in width; anterior coxae projecting; suture lines of first, second and third coxae developed, although those between second and third coxae are shortest; glands of the fourth coxae extending forward in a line with the epimeroglandularia 1 and form a loop-like suture line between the third and fourth coxae; median coxal suture line well developed; openings for insertion of the fourth legs partially covered by flap-like projections which extend somewhat anterolaterally; a pair of apophyses present near posterior area of fourth coxae; genital field incorporated into the ventral shield without a trace of a suture line; three pairs of genital acetabula; width between outer edges of second pair $96\mu\text{m}$ ($89\mu\text{m}$); gonopore small, $17\mu\text{m}$ ($14\mu\text{m}$) in length, and placed anterior to the acetabula; excretory pore lying on the ventral shield; figure 179 shows the ventral shield; dorsal lengths of the palpal segments: P-I, $12\mu\text{m}$ ($14\mu\text{m}$); P-II, $45\mu\text{m}$ ($46\mu\text{m}$); P-III, $32\mu\text{m}$ ($33\mu\text{m}$); P-IV, $46\mu\text{m}$ ($46\mu\text{m}$); P-V, $24\mu\text{m}$ ($22\mu\text{m}$); one thickened, posteromedial seta on P-III; figure 180 illustrates the proportions and chaetotaxy of the palp; capitulum, including the long anchoral process, $111\mu\text{m}$ ($114\mu\text{m}$) in length; chelicera $107\mu\text{m}$ ($100\mu\text{m}$) in length; structure of the capitulum and chelicera as shown for the female; dorsal lengths of the distal segments of the first leg: I-Leg-4, $54\mu\text{m}$ ($57\mu\text{m}$); I-Leg-5, $55\mu\text{m}$ ($55\mu\text{m}$); I-Leg-6, $60\mu\text{m}$ ($62\mu\text{m}$); these segments as shown for the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $76\mu\text{m}$ ($76\mu\text{m}$); IV-Leg-5, $87\mu\text{m}$ ($83\mu\text{m}$); IV-Leg-6, $83\mu\text{m}$ ($79\mu\text{m}$); swimming hairs absent.

Female: Dorsal and ventral shields, except for genital field area, as described for male; dorsal shield $403\mu\text{m}$ ($388\mu\text{m}$ - $429\mu\text{m}$) in length, $243\mu\text{m}$ ($217\mu\text{m}$ - $243\mu\text{m}$) in width; posterior plate of dorsum $76\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$) in length; ventral shield $426\mu\text{m}$ ($410\mu\text{m}$ - $456\mu\text{m}$) in length, $258\mu\text{m}$ ($243\mu\text{m}$ - $274\mu\text{m}$) in width;

three pairs of genital acetabula; width between outer edges of most lateral pair $103\mu\text{m}$ ($100\mu\text{m}$ - $111\mu\text{m}$); gonopore placed farther forward than in male; gonopore $55\mu\text{m}$ ($53\mu\text{m}$) in length, $31\mu\text{m}$ ($29\mu\text{m}$ - $30\mu\text{m}$) in width; postgenital sclerite area prominent; figure 177 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $12\mu\text{m}$ ($14\mu\text{m}$); P-II, $48\mu\text{m}$ ($50\mu\text{m}$ - $53\mu\text{m}$); P-III, $36\mu\text{m}$ ($35\mu\text{m}$ - $40\mu\text{m}$); P-IV, $48\mu\text{m}$ ($47\mu\text{m}$ - $52\mu\text{m}$); P-V, $25\mu\text{m}$ ($25\mu\text{m}$ - $26\mu\text{m}$); palp similar to that of male, with the heavy seta on medial surface of P-III present; capitulum $114\mu\text{m}$ ($109\mu\text{m}$ - $121\mu\text{m}$) in length; chelicera $107\mu\text{m}$ ($104\mu\text{m}$ - $107\mu\text{m}$) in length; figure 178 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $57\mu\text{m}$ ($55\mu\text{m}$ - $62\mu\text{m}$); I-Leg-5, $59\mu\text{m}$ ($56\mu\text{m}$ - $59\mu\text{m}$); I-Leg-6, $66\mu\text{m}$ ($62\mu\text{m}$ - $67\mu\text{m}$); figure 176 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $80\mu\text{m}$ ($76\mu\text{m}$ - $83\mu\text{m}$); IV-Leg-5, $85\mu\text{m}$ ($86\mu\text{m}$ - $90\mu\text{m}$); IV-Leg-6, $83\mu\text{m}$ ($83\mu\text{m}$ - $87\mu\text{m}$); swimming hairs absent.

Holotype: Adult σ , from a tributary of the Motupiko River on Rt. 6, between Korere and Glenhope, South Island, Nov. 25, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: SOUTH ISLAND: 2 f , same area as holotype on Nov. 7, 1982; 1 σ , same data as holotype; 1 f , from the Hope River on Rt. 6, between Glenhope and Kawatiri, Nov. 25, 1982.

Discussion: The characteristics given in the generic diagnosis will easily separate the present form from all other known species.

Genus ASPIDIOBATES Lundblad

32. Aspidiobates orbiculatus Hopkins

(Figs. 186-189, 192)

Aspidiobates orbiculatus Hopkins, 1975. Jour. Royal Soc. New Zealand, 5: 5.

Female: Dorsal and ventral shields present; dorsal shield entire, $851\mu\text{m}$ in length, $714\mu\text{m}$ in width; dorsal shield bearing the postocularia and three pairs of glandularia; two pairs of glandularia lying in the dorsal furrow; figure 188 shows the structure of the dorsal shield; ventral shield $966\mu\text{m}$ in length, $820\mu\text{m}$ in width; first coxae projecting slightly beyond body; coxal area confined to the anterior half of ventral shield; glands of the fourth coxae extending forward to form a loop-like suture line which constricts the more medial portion of the third coxae; muscle scar apodemes forming the lateral edges of the loop cause the fourth coxae to appear rectangular; three pairs of genital acetabula; width between outer edges of second pair of genital acetabula $259\mu\text{m}$; gonopore $162\mu\text{m}$ in length, $155\mu\text{m}$ in width; a pair of apophyses present lateral to the genital field; figure 189 illustrates the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $29\mu\text{m}$; P-II, $103\mu\text{m}$; P-III, $111\mu\text{m}$; P-IV, $143\mu\text{m}$; P-V, $26\mu\text{m}$; medial surface of P-IV with a peg-like seta; figure 192 shows the proportions and chaetotaxy of the palp; capitulum $251\mu\text{m}$ in length; chelicera $273\mu\text{m}$ in length; figure 186 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $200\mu\text{m}$; I-Leg-5, $192\mu\text{m}$; I-Leg-6, $177\mu\text{m}$; figure 187 shows I-Leg-5 and 6; swimming hairs absent.

Male: See Hopkins (1975).

Material Examined: I did not recollect this seepage area form and the il-

illustrations are based on a specimen sent to me by Dr. Ceri Hopkins. It is included only for the sake of completeness and to use in later comparisons with the Australian members of the genus.

Genus ACICULACARUS Hopkins

33. Aciculacarus papillosus Hopkins

(Figs. 190, 191, 193-197)

Aciculacarus papillosus Hopkins, 1975. Jour. Royal Soc. New Zealand, 5: 7.

Male: A completely sclerotized ventral shield present but dorsum soft; ventral shield $593\mu\text{m}$ - $623\mu\text{m}$ in length, $410\mu\text{m}$ - $441\mu\text{m}$ in width; anterior coxae projecting; suture lines of the individual coxal groups evident, except no medial suture lined for first coxae; glands of the fourth coxae located medially near suture line between third and fourth coxae; posterior suture lines of fourth coxae evident and extending at right angles to the long axis of the body; genital field lying on a plate (homologous to that shown in figure 201) which is incorporated into the ventral shield but the suture line is distinct; width of this plate $192\mu\text{m}$ - $222\mu\text{m}$; three pairs of genital acetabula; width between outer edges of middle pair of acetabula $141\mu\text{m}$ - $155\mu\text{m}$; gonopore $25\mu\text{m}$ - $26\mu\text{m}$ in width; excretory pore terminal; figure 193 shows the structure of the ventral shield; dorsum soft and bearing the pre- and postocularia, five pairs of "normal" glandularia and two pairs of setae (which apparently are the homologs of an additional two pairs of glandularia); dorsum as shown for the female; dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$ - $29\mu\text{m}$; P-II, $59\mu\text{m}$ - $63\mu\text{m}$; P-III, $65\mu\text{m}$ - $67\mu\text{m}$; P-IV, $100\mu\text{m}$ - $102\mu\text{m}$; P-V, $29\mu\text{m}$ - $31\mu\text{m}$; figure 190 shows the proportions and chaetotaxy of the palp; capitulum $177\mu\text{m}$ - $185\mu\text{m}$ in length; capitulum tapering more or less to a point anteriorly; chelicera $288\mu\text{m}$ - $311\mu\text{m}$ in length; cheliceral claw elongated and needle-like (fig. 195); dorsal lengths of the distal segments of the first leg: I-Leg-4, $104\mu\text{m}$ - $109\mu\text{m}$; I-Leg-5, $114\mu\text{m}$ - $117\mu\text{m}$; I-Leg-6, $131\mu\text{m}$ - $133\mu\text{m}$; these segments as in the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $149\mu\text{m}$ - $156\mu\text{m}$; IV-Leg-5, $162\mu\text{m}$ - $173\mu\text{m}$; IV-Leg-6, $147\mu\text{m}$ - $162\mu\text{m}$; swimming hairs absent.

Female: The unsclerotized dorsum and the ventral shield (except for genital field region) as described for male; figure 194 shows the dorsum; ventral shield $623\mu\text{m}$ - $707\mu\text{m}$ in length, $456\mu\text{m}$ - $532\mu\text{m}$ in width; genital field on a plate fused with the ventral shield but the suture lines of this plate are evident; width of this plate $222\mu\text{m}$ - $236\mu\text{m}$; three pairs of genital acetabula; width between outer edges of most lateral pair of acetabula $183\mu\text{m}$ - $185\mu\text{m}$; gonopore $103\mu\text{m}$ - $110\mu\text{m}$ in width; figure 197 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $31\mu\text{m}$ - $35\mu\text{m}$; P-II, $63\mu\text{m}$ - $69\mu\text{m}$; P-III, $71\mu\text{m}$ - $75\mu\text{m}$; P-IV, $107\mu\text{m}$ - $111\mu\text{m}$; P-V, $31\mu\text{m}$ - $32\mu\text{m}$; structure of palp as in male; capitulum $185\mu\text{m}$ - $211\mu\text{m}$ in length; chelicera $318\mu\text{m}$ in length; figure 191 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $107\mu\text{m}$ - $112\mu\text{m}$; I-Leg-5, $117\mu\text{m}$ - $121\mu\text{m}$; I-Leg-6, $133\mu\text{m}$ - $136\mu\text{m}$; figure 196 shows these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $155\mu\text{m}$ - $159\mu\text{m}$; IV-Leg-5, $172\mu\text{m}$ - $185\mu\text{m}$; IV-Leg-6, $163\mu\text{m}$ - $167\mu\text{m}$; swimming hairs absent.

Material Examined: NORTH ISLAND: 2 ♂, 1 ♀, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula),

Oct. 27, 1982; 1 ♀, from a stream on Rt 6, just north of the Makatote Viaduct between Raetiki and National Park, Nov. 2, 1982; SOUTH ISLAND: 1 ♂, from a tributary of the Motupiko River on Rt. 6, between Korere and Glenhope, Nov. 7, 1982; 1 ♀, same area on Nov. 25, 1982.

Discussion: *Aciculacarus papillosus* belongs to a group of austral hygrobatids which includes *Rhynchaturus* (Chile and Argentina) and at least four undescribed species from Australia. Other members of the group have mouthparts capable of a great deal of protrusion, but not the present species. This group of mites exhibits varying degrees of sclerotization. Some, like the following species, lack secondary sclerotization and others, such as *Rhynchaturus*, have both dorsal and ventral shields (although the dorsal shield is made up of several closely fitting platelets). Three of the four Australian species have ventral shields as does the present species. An examination of the Australian species of this group indicates that the two pairs of setae slightly anterior to the four glandularia sclerites at the posterior end of the dorsal shield (fig. 194) represent homologs of glandularia in which the gland portion has disappeared. In one of the Australian species, one pair of these posterior glandularia has become reduced to setal bases as in the present species. The New Zealand species of the group are characterized by having two of the glandularia pairs of the dorsum losing the gland portion and in having extremely enlarged cheliceral claws, both of which appear to be synapomorphic. The whole group will be analysed at the time the Australian species are described. The following species, although appearing quite different because of its unsclerotized venter, is related to the present species.

34. *Aciculacarus amilis*, new species

(Figs. 198-202)

Male: Body, other than the primary sclerites, soft and without muscle attachment platelets; body $487\mu\text{m}$ in length; first coxae separated medially; capitular bay V-shaped; epimeroglandularia 1 fused with the second coxae; glands of the fourth coxae near medial margins of fourth coxae and well posterior to the suture line between third and fourth coxae; posterior suture lines of fourth coxae evident; epimeroglandularia 2 lying in sclerotization immediately posterior to the fourth coxae; genital field lying on a plate $118\mu\text{m}$ in length, $177\mu\text{m}$ in width; three pairs of genital acetabula, width between outer edges of second pair $140\mu\text{m}$; gonopore $44\mu\text{m}$ in length; genital field with numerous setae, both lateral and medial to the acetabula; excretory pore not on a sclerite and is terminal in position; figure 201 illustrates the venter; dorsum with the pre- and postocularia, five pairs of "normal" glandularia posterior to the postocularia, and two pairs of setae (which are the homologs of glandularia); figure 200 shows the dorsum; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$; P-II, $58\mu\text{m}$; P-III, $60\mu\text{m}$; P-IV, $88\mu\text{m}$; P-V, $38\mu\text{m}$; figure 198 shows the proportions and chaetotaxy of the palp; capitulum $200\mu\text{m}$ in length; capitulum elongated, pointed at anterior end and attached to a tube of soft integument to form protrusible mouthparts; chelicera $303\mu\text{m}$ in length; cheliceral claw elongated and needle-like; figure 202 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $104\mu\text{m}$; I-Leg-5, $107\mu\text{m}$; I-Leg-6, $121\mu\text{m}$; figure 199 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $138\mu\text{m}$; IV-Leg-5, $159\mu\text{m}$; IV-Leg-6, $149\mu\text{m}$; swimming hairs absent.

Female: Unknown.

Holotype: Adult ♂, from a stream at Sandy's Bridge on Rt. 2, in the "Gorge" south of Opotiki, North Island, June 3, 1981.

Discussion: As mentioned under the discussion section of the previous species, the major differences between these two New Zealand forms are the unsclerotized venter of the present species and its proportionally longer and more protrusible capitulum.

The CORTICACARUS-like Mites

Discussion: Four members of the *Corticacarus*-like hydrachnids are now known from New Zealand: *Zelandobatella naias*, *Zelandobates crinitus*, and two new species tentatively assigned to the latter genus. The *Corticacarus*-like forms have a wide range in the New World, with a few species occurring in the austral portion of South America, the bulk of the species confined to the neotropics, and one species taken as far north as Idaho in the United States. Five species assigned to a new subgenus of *Corticacarus*, *Procorticacarus*, have been described by K. O. Viets (1978b) from Australia. Additional species from Australia which are presently undescribed will bring the total to at least 14, and all fit well in *Procorticacarus*. New Zealand, with only four species, is the most species impoverished.

The *Corticacarus*-like hydrachnids of Australia, New Zealand and the New World exhibit certain rather stable differences from each other suggesting they have been isolated for a long time. Three major characters are here used to distinguish the mites of each area: Glandularia of the dorsum, morphology of the male gonopore and presence or absence of a projection on the ventral side of P-II.

NEW ZEALAND: (1) All glandularia of the dorsum of approximately the same size and morphology (2) No ventral projection on P-II (3) Male gonopore relatively long and narrow, and unspecialized. Utilizing other southern hygrobatids for out group comparisons, it seems certain all three of these character states are plesiomorphic.

AUSTRALIA: (1) All glandularia of the dorsum of approximately the same size and morphology (2) A ventral projection is present on P-II (3) Male gonopore is shortened and proportionally widened. The last two character states are apomorphic relative to the New Zealand mites.

NEW WORLD: (1) Four pairs of the dorsal glandularia typically enlarged and somewhat heart-shaped, others similar to those found in the Australasian mites (2) P-II, with rare exceptions, with a ventral projection (3) Male gonopore shortened and generally widened. All three of these character states are apomorphic relative to the New Zealand species but only the first character state is derived relative to the Australian corticacarids.

It is tempting to consider the less derived condition of the New Zealand species to be the result of the earlier separation of this region while the other two were still joined as part of Gondwanaland. However, far more characters need to be examined and the results of a collecting trip to Chile incorporated before any conclusions should be drawn.

Genus ZELANDOBATES Hopkins

Diagnosis: Characters of the New Zealand *Corticacarus*-like mites as given earlier on this page; surface of integument and plates varying from relatively

smooth to rough and papillose; first coxae fused medially; genital field flanked by two pairs of muscle attachment platelets (fig. 208); anterior portion of male dorsum with a large anteromedial plate bearing the postocularia and three pairs of glandularia; posterior portion of male dorsum with a smaller median platelet and two lateral platelets (figs. 206, 226); female dorsum similar but anterodorsal plate smaller and bearing only the postocularia; three pairs of glandularia sclerites, one of which is associated with muscle attachment platelets, are free in the integument surrounding the anteromedial plate (these three glandularia sclerites fused with the anteromedial plate in the male).

35. Zelandobates crinitus Hopkins

(Figs. 223-227, 229, 231)

Zelandobates crinitus Hopkins, 1966. Trans. Royal Soc. New Zealand, 8: 113.

Male: Integument finely lined, but with development of dorsal sclerites so extensive as to nearly form a dorsal shield; dorsal and ventral sclerites relatively smooth; body $470\mu\text{m}$ - $492\mu\text{m}$ in length; dorsum with a large anteromedial plate $354\mu\text{m}$ - $380\mu\text{m}$ in length, $304\mu\text{m}$ - $319\mu\text{m}$ in width; this plate bearing the postocularia and three pairs of glandularia; two of the glandularia on the dorsal plate and one pair flanking it with very long setae; antenniform setae located on a common sclerite; one small median and two pairs of small lateral platelets near posterior end of dorsum; figure 226 illustrates these sclerites; length between anterior end of first coxae and posterior end of genital field $458\mu\text{m}$ - $472\mu\text{m}$; first coxae fused medially; capitular bay V-shaped; epimeroglandularia 1 fused with the second coxae; medial margins of the posterior coxal groups long and close together; glands of the fourth coxae located near suture lines between third and fourth coxae; genital field $101\mu\text{m}$ - $111\mu\text{m}$ in length, $126\mu\text{m}$ - $133\mu\text{m}$ in length, $126\mu\text{m}$ - $133\mu\text{m}$ in width; gonopore long and narrow ($66\mu\text{m}$ - $74\mu\text{m}$ in length, $12\mu\text{m}$ - $13\mu\text{m}$ in width); three pairs of genital acetabula; genital field flanked by two pairs of muscle attachment platelets; excretory pore located immediately posterior to the genital field; figure 224 shows the morphology of the venter; dorsal lengths of the palpal segments: P-I, $24\mu\text{m}$ - $28\mu\text{m}$; P-II, $86\mu\text{m}$ - $89\mu\text{m}$; P-III, $79\mu\text{m}$ - $84\mu\text{m}$; P-IV, $109\mu\text{m}$ - $113\mu\text{m}$; P-V, $47\mu\text{m}$ - $51\mu\text{m}$; papillae extending well up medial surface of P-II and P-III; no ventral projection on P-II; figure 223 shows the proportions and chaetotaxy of the palp; capitulum $146\mu\text{m}$ - $148\mu\text{m}$ in length; chelicera $177\mu\text{m}$ - $185\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $120\mu\text{m}$ - $133\mu\text{m}$; I-Leg-5, $115\mu\text{m}$ - $133\mu\text{m}$; I-Leg-6, $96\mu\text{m}$ - $118\mu\text{m}$; structure of these segments as illustrated for the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $122\mu\text{m}$ - $140\mu\text{m}$; IV-Leg-5, $143\mu\text{m}$ - $162\mu\text{m}$; IV-Leg-6, $126\mu\text{m}$ - $155\mu\text{m}$; swimming hairs absent.

Female: Integument soft; dorsal and ventral plates and platelets smaller and more widely separated than in male; body $608\mu\text{m}$ - $684\mu\text{m}$ in length; dorsum with a large anteromedial plate $304\mu\text{m}$ - $399\mu\text{m}$ in length, $197\mu\text{m}$ - $293\mu\text{m}$ in width; this plate bearing only the postocularia; other platelets and glandularia similar to male but the two smaller pairs of anterior glandularia and one pair of combined glandularia-muscle attachment platelet not fused with the large anterior plate (fig. 225); length between anterior end of first coxae and posterior end of genital field $517\mu\text{m}$ - $608\mu\text{m}$; first coxae fused medially; capitular bay V-shaped; the epimeroglandularia 1 fused with second coxae; medial margins of posterior coxal groups much shorter than in male and well separated from each other; glands of

the fourth coxae located near suture lines between third and fourth coxae; genital field $167\mu\text{m}$ - $192\mu\text{m}$ in width; length between anterior end of pregenital sclerite and posterior end of postgenital sclerite $133\mu\text{m}$ - $162\mu\text{m}$; three pairs of genital acetabula; two pairs of muscle attachment platelets flanking the genital field; figure 227 illustrates the venter; dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$ - $31\mu\text{m}$; P-II, $90\mu\text{m}$ - $116\mu\text{m}$; P-III, $90\mu\text{m}$ - $107\mu\text{m}$; P-IV, $121\mu\text{m}$ - $169\mu\text{m}$; P-V, $55\mu\text{m}$ - $69\mu\text{m}$; capitulum $162\mu\text{m}$ - $199\mu\text{m}$ in length; chelicera $192\mu\text{m}$ - $214\mu\text{m}$ in length; figure 231 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $118\mu\text{m}$ - $148\mu\text{m}$; I-Leg-5, $111\mu\text{m}$ - $155\mu\text{m}$; I-Leg-6, $104\mu\text{m}$ - $126\mu\text{m}$; figure 229 shows these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $122\mu\text{m}$ - $159\mu\text{m}$; IV-Leg-5, $152\mu\text{m}$ - $185\mu\text{m}$; IV-Leg-6, $141\mu\text{m}$ - $164\mu\text{m}$; swimming hairs absent.

Material Examined: NORTH ISLAND: 1 ♂, 2 ♀, from a stream on Rt 12 at Kaihu (Northland), May 29, 1981; 5 ♀, Pohue Stream at Waiomu (Coromandel Peninsula), Oct. 26, 1982; 1 ♀, from Haparapara River, 4 km north of Omaio (East Cape District), Oct. 28, 1982; 1 ♂, 3 ♀, from stream at Owiritoa Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 3 ♀, Mangamawhete Stream on Rt 3, between Inglewood and Stratford (Egmont area), Nov. 1, 1982; 3 ♀, from headwaters of Whangamata Stream 10 km northwest of Taupo, Nov. 3, 1982; 1 ♂, 3 ♀, Otupoto Stream on Rt 32, west of Lake Taupo, Nov. 3, 1982; SOUTH ISLAND: 6 ♂, 23 ♀, Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, Nov. 6, 1982; 1 ♀, Whangamoa River on Rt 6, 3 km northeast of Whangamoa Saddle (north of Nelson), Nov. 6, 1982; 1 ♂, 3 ♀, Little Hope River on Rt. 6, at bridge slightly southwest of Hope Saddle (near Glenhope), Nov. 7, 1982; 1 ♀, from the Whitehorse Creek on Rt. 6, south of Four Mile River (between towns of the same name), Nov. 8, 1982; 1 ♀, Wind Bag River on Rt. 6, between Lake Paringa and Lake Moeraki (north of Haast), Nov. 10, 1982; 1 ♀, Dunton Creek on Rt. 94, 85 km south of Milford Sound, Nov. 14, 1982; 3 ♀, 13 ♀, Shag River near its headwaters, on Rt 85, 2 km west of Pigroot Summit (Central Otago), Nov. 16, 1982; 2 ♀, 5 ♀, White Rock River (southwest of Timaru), where Cliffs Rd branches off Pareora-Cave Rd, Nov. 18, 1982; 8 ♂, 1 ♀, small creek on Rt. 6, approx. 10 km west of Havelock (northern South Island), Nov. 22, 1982; 2 ♀, Hope River on Rt 6, between Glenhope and Kawatiri, Nov. 25, 1982.

36. Zelandobates tornus, new species

(Figs. 203-209)

Male: Integument soft but with papillae; dorsal and ventral sclerites well developed and these also noticeably papillate; body $486\mu\text{m}$ ($471\mu\text{m}$ - $547\mu\text{m}$) in length; dorsum with a large anteromedial plate $247\mu\text{m}$ ($236\mu\text{m}$ - $262\mu\text{m}$) in length, $288\mu\text{m}$ ($274\mu\text{m}$ - $304\mu\text{m}$) in width; this plate bearing the postocularia and three pairs of glandularia; anterior plate with distinct ridges which are better illustrated (fig. 206) than described; none of the dorsal setae exceptionally long; antenniform setae on a common sclerite; one median and two lateral pairs of muscle attachment platelets in posterior portion of dorsum; length between anterior end of first coxae and posterior end of genital field $456\mu\text{m}$ ($440\mu\text{m}$ - $479\mu\text{m}$); the first coxae fused medially; capitular bay somewhat V-shaped; epimeroglandularia 1 fused with the second coxae; medial margins of posterior coxal groups relatively short and separated from each other medially; glands of the fourth coxae located near suture lines between third and fourth coxae; genital field $111\mu\text{m}$ ($118\mu\text{m}$ - $125\mu\text{m}$) in length, $141\mu\text{m}$ ($140\mu\text{m}$ - $145\mu\text{m}$) in width; gonopore long and narrow,

78 μ m (74 μ m-85 μ m) in length, approximately 25 μ m in width; a row of setae at anterior end of genital field; three pairs of genital acetabula, anterior pair well separated from the other two pairs; two pairs of muscle attachment platelets present in posterior half of venter; excretory pore near posterior end; figure 207 shows the morphology of the venter; dorsal lengths of the palpal segments: P-I, 22 μ m (21 μ m-26 μ m); P-II, 69 μ m (64 μ m-73 μ m); P-III, 74 μ m (69 μ m-79 μ m); P-IV, 83 μ m (76 μ m-85 μ m); P-V, 45 μ m (40 μ m-42 μ m); ventral side of P-II and P-III with numerous papillae; no projection on ventral side of P-II; capitulum 140 μ m (137 μ m-162 μ m) in length; chelicera 185 μ m (178 μ m-200 μ m) in length; figure 204 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 103 μ m (89 μ m-103 μ m); I-Leg-5, 104 μ m (96 μ m-115 μ m); I-Leg-6, 111 μ m (103 μ m-118 μ m); first leg as shown for the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 141 μ m (126 μ m-148 μ m); IV-Leg-5, 155 μ m (141 μ m-162 μ m); IV-Leg-6, 148 μ m (133 μ m-148 μ m); swimming hairs absent.

Female: Integument soft and papillate; dorsal and ventral plates and platelets more widely separated than in male; body 668 μ m (593 μ m-623 μ m) in length; dorsum with an anteromedial plate 247 μ m (228 μ m-273 μ m) in length, 258 μ m (258 μ m-273 μ m) in width; this plate somewhat pointed posteriorly and bearing the postocularia; other plates and glandularia similar to male but two smaller pairs of anterior glandularia and one pair of combined glandularia-muscle attachment platelet not fused with anteromedial plate (fig. 205); length between anterior end of first coxae and posterior end of genital field 638 μ m (547 μ m-593 μ m); first coxae fused medially; capitular bay somewhat V-shaped; epimeroglandularia 1 fused with second coxae; medial margins of posterior coxal groups short and widely separated medially; glands of the fourth coxae located near suture lines between third and fourth coxae; genital field 192 μ m (190 μ m-194 μ m) in width; length between anterior end of pregenital sclerite and posterior end of postgenital sclerite 148 μ m (126 μ m-141 μ m); three pairs of genital acetabula; two pairs of muscle attachment platelets in posterior half of venter; posterior pair of these platelets relatively long and narrow; figure 208 illustrates the venter; dorsal lengths of the palpal segments: P-I, 26 μ m-34 μ m; P-II, 98 μ m (96 μ m-111 μ m); P-III, 97 μ m (96 μ m-107 μ m); P-IV, 112 μ m (117 μ m-124 μ m); P-V, 50 μ m (54 μ m-59 μ m); papillae extending well up medial sides of P-II and P-III; no ventral projection on P-II; figure 203 shows the proportions and chaetotaxy of the palp; the capitulum 177 μ m-185 μ m in length; chelicera 222 μ m-229 μ m in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 118 μ m (121 μ m-133 μ m); I-Leg-5, 118 μ m (120 μ m-131 μ m); I-Leg-6, 118 μ m (120 μ m-126 μ m); figure 209 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 155 μ m (155 μ m-167 μ m); IV-Leg-5, 177 μ m (179 μ m-192 μ m); IV-Leg-6, 170 μ m (163 μ m-180 μ m); swimming hairs absent.

Holotype: Adult σ , from Pohue Stream at Waiomu (Coromandel Peninsula), North Island, Oct. 26, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: NORTH ISLAND: 6 σ , 1 f , stream on Rt 12 at Kaihu (Northland), May 29, 1981; 1 σ , Otupoto Stream on Rt 32, between Hingarae Rd and Waihaha Rd (west of Taupo), June 6, 1981; 1 f , Orauhora Stream on Rt 30, between Barryville and Benneydale, June 6, 1981; 1 f , from river at Broadwood in northern North Island, Oct. 21, 1982; 1 σ , 1 f , from Waima River on Rt. 12, 7 km west of Taheke, Oct. 24, 1982; 4 σ , 15 f , same data as holotype; 13 σ , 22 f , Tapu River at Tapu (Coromandel Peninsula), Oct. 26, 1982; 4 σ , 17 f , from Tapu River, 1 km east of Tapu (Coromandel Peninsula), Oct. 27, 1982; 1 f , from a tributary of the

Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 1 ♂, 1 ♀, Torere River at Torere on Rt. 35 north of Opotiki, Oct. 28, 1982; 1 ♀, stream at Owahiritoa Bridge, on Rt 2 in the "Gorge" south of Opotiki, Oct. 29, 1982; 1 ♀, from a stream at Omaukoro Bridge on Rt 2, in "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 4 ♀, from Dunton Creek on Rt 94, 85 km south of Milford Sound, Nov. 14, 1982.

Discussion: At first glance, the rugose surface of the dorsal and ventral plates and platelets of the present species contrasts so strongly with the smooth surfaces found in *crinitus* that the similarities might be overlooked. However, the dorsal and ventral sclerites are homologous in position as is their degree of fusion in the two sexes of the two species, and so they seem congeneric. Some of the differences separating the two species are the long dorsal setae in *crinitus* (figs. 225, 226) and distinct ridges on the anteromedial plate of *tornus*. Actually, the present species is most closely related to the following, *Z. clevatus*. See remarks under the latter.

37. Zelandobates clevatus, new species

(Figs. 210-213, 215, 216, 218, 605)

Male: Integument soft but with low papillae; dorsal and ventral sclerites well developed and these also noticeably papillate; dorsal and ventral sclerites less rugose than in the previous species; body $532\mu\text{m}$ ($464\mu\text{m}$ - $532\mu\text{m}$) in length; dorsum with a large anteromedial plate $282\mu\text{m}$ ($258\mu\text{m}$ - $304\mu\text{m}$) in length, $319\mu\text{m}$ ($289\mu\text{m}$ - $334\mu\text{m}$) in width; this plate bearing the postocularia and three pairs of glandularia; anterior plate lacking the well developed ridges characteristic of the previous species (fig. 605); none of the dorsal setae especially long; antenniform setae each on a separate base; one median and two pairs of lateral muscle attachment platelets in posterior half of dorsum; a pair of glandularia fused with posteromedial platelet (fig. 215); length between anterior end of first coxae and posterior end of genital field $502\mu\text{m}$ ($433\mu\text{m}$ - $510\mu\text{m}$); first coxae fused medially; capitular bay somewhat V-shaped; epimeroglandularia 1 fused with the second coxae; medial margins of posterior coxal groups of moderate length and relatively close together; glands of the fourth coxae located near suture lines between third and fourth coxae; genital field $104\mu\text{m}$ ($89\mu\text{m}$ - $100\mu\text{m}$) in length, $133\mu\text{m}$ ($126\mu\text{m}$ - $139\mu\text{m}$) in width; gonopore long and narrow, $74\mu\text{m}$ ($60\mu\text{m}$ - $74\mu\text{m}$) in length, $22\mu\text{m}$ ($19\mu\text{m}$ - $24\mu\text{m}$) in width; a row of setae on each side anterior to the gonopore; three pairs of genital acetabula, these more or less evenly spaced on their respective sides; two pairs of muscle attachment platelets present in the posterior half of venter; excretory pore terminal; figure 210 shows the venter; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($24\mu\text{m}$); P-II, $76\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$); P-III, $74\mu\text{m}$ ($71\mu\text{m}$ - $77\mu\text{m}$); P-IV, $91\mu\text{m}$ ($85\mu\text{m}$ - $87\mu\text{m}$); P-V, $43\mu\text{m}$ ($45\mu\text{m}$); ventral side of P-II and P-III with numerous papillae; no ventral projection on P-II; capitulum $152\mu\text{m}$ ($141\mu\text{m}$ - $155\mu\text{m}$) in length; chelicera $192\mu\text{m}$ ($170\mu\text{m}$ - $192\mu\text{m}$) in length; figure 213 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $118\mu\text{m}$ ($104\mu\text{m}$ - $122\mu\text{m}$); I-Leg-5, $122\mu\text{m}$ ($103\mu\text{m}$ - $124\mu\text{m}$); I-Leg-6, $122\mu\text{m}$ ($108\mu\text{m}$ - $127\mu\text{m}$); these segments as illustrated for the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $155\mu\text{m}$ ($141\mu\text{m}$ - $152\mu\text{m}$); IV-Leg-5, $170\mu\text{m}$ ($155\mu\text{m}$ - $170\mu\text{m}$); IV-Leg-6, $159\mu\text{m}$ ($143\mu\text{m}$ - $155\mu\text{m}$); swimming hairs absent.

Female: Integument soft; dorsal and ventral plates and platelets more widely separated than in male; body $744\mu\text{m}$ ($653\mu\text{m}$ - $730\mu\text{m}$) in length; dorsum with

an anteromedial plate $281\mu\text{m}$ ($236\mu\text{m}$ - $304\mu\text{m}$) in length, $266\mu\text{m}$ ($251\mu\text{m}$ - $304\mu\text{m}$) in width; this plate somewhat pointed, bearing the postocularia and with extremely low ridges; two pairs of glandularia platelets and one pair of combination glandularia-muscle attachment platelets flanking the anteromedial plate (these fused with the plate in the male); glandularia flanking the small posteromedial platelet not fused with it as in male (fig. 216); length between anterior end of the first coxae and posterior end of genital field $699\mu\text{m}$ ($608\mu\text{m}$ - $654\mu\text{m}$); first coxae fused medially; capitular bay somewhat U-shaped; epimeroglandularia 1 fused with the second coxae; medial margins of posterior coxal groups short and well separated medially; glands of the fourth coxae located near suture lines between third and fourth coxae; genital field $207\mu\text{m}$ ($199\mu\text{m}$ - $229\mu\text{m}$) in width; length between anterior end of pregenital sclerite and posterior end of postgenital sclerite $177\mu\text{m}$ ($170\mu\text{m}$ - $185\mu\text{m}$); three pairs of genital acetabula; two pairs of muscle attachment platelets located in posterior portion of venter; posterior pair of these platelets relatively narrow; figure 211 illustrates the venter; dorsal lengths of the palpal segments: P-I, $28\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); P-II, $107\mu\text{m}$ ($100\mu\text{m}$ - $111\mu\text{m}$); P-III, $107\mu\text{m}$ ($107\mu\text{m}$ - $110\mu\text{m}$); P-IV, $131\mu\text{m}$ ($133\mu\text{m}$ - $138\mu\text{m}$); P-V, $62\mu\text{m}$ ($61\mu\text{m}$ - $62\mu\text{m}$); ventral papillae extending well up medial sides of P-II and P-III; no ventral projection on P-II; figure 212 shows a medial view of the palp; capitulum $192\mu\text{m}$ ($192\mu\text{m}$ - $214\mu\text{m}$) in length; chelicera $259\mu\text{m}$ ($236\mu\text{m}$ - $263\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $145\mu\text{m}$ ($135\mu\text{m}$ - $152\mu\text{m}$); I-Leg-5, $141\mu\text{m}$ ($128\mu\text{m}$ - $148\mu\text{m}$); I-Leg-6, $140\mu\text{m}$ ($133\mu\text{m}$ - $141\mu\text{m}$); figure 218 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $177\mu\text{m}$ ($177\mu\text{m}$ - $192\mu\text{m}$); IV-Leg-5, $196\mu\text{m}$ ($189\mu\text{m}$ - $214\mu\text{m}$); IV-Leg-6, $189\mu\text{m}$ ($185\mu\text{m}$ - $192\mu\text{m}$); swimming hairs absent.

Holotype: Adult ♂, from the MacLennan River at bridge on Aurora Creek Rd (Catlin State Forest area), between Puketiro and Rt 92, South Island, Nov. 12, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 14 ♀, from a spring at the summit of Desert Road (at AA pullout) south of Lake Taupo, North Island, Nov. 4, 1982; 1 ♂, 2 ♀, same data as holotype; 4 ♀, from Boyd Creek on Rt. 94, 76 km south of Milford Sound, South Island, Nov. 14, 1982.

Discussion: The present species is closely related to the preceding species and the major differences are best shown by the males. The male anterodorsal plate of the present species is more octagonal and the ridges are much lower. The small posteromedial plate has a pair of glandularia fused with it in *clevatus*. There are also differences in the genital field with the acetabula more or less evenly placed in males of the present species. Females may be distinguished by the lack of darker integumental pigment, the presence of separate antenniform setae bases, and lower ridges on the dorsal sclerites in the present species (these differences are also found in males of the two species).

Genus ZELANDOBATELLA Hopkins

Diagnosis and Discussion: This genus shares with *Zelandobates* the major (although plesiomorphic) characteristics of a relatively unmodified male gonopore, all glandularia of the dorsum similar and no ventral projection on P-II. The differences separating *Zelandobatella* and *Zelandobates* are as follows: Postocularia are on separate platelets in the present genus. Although these might expand and fuse to form a condition similar to that of the preceding genus, the posteromedial sclerite is missing in *Zelandobatella*. There are three lateral

pairs of dorsalia in both genera, but the anterior pair in *Zelandobatella* is not fused with glandularia. The coxae are proportionally much smaller in the present genus and the first coxae are separated medially. The male gonopore shows some indication of widening in the present genus (fig. 219), but it is still proportionally much longer and narrower than in any of the South American or Australian *Corticacarus*-like mites. Appendages are rather similar in the two New Zealand genera but papillae are lacking on the ventral side of P-II in the present genus (fig. 214). An initial impression is that *Zelandobatella* is closer to the New World *Paracorticacarus*-like species and *Zelandobates* closer to the New World members of the typical subgenus. However, this almost certainly is the result of convergence, for the New World forms are all synapomorphic for the three major characters discussed in the introduction to the *Corticacarus*-like mites.

38. *Zelandobatella naias* Hopkins

(Figs. 214, 217, 219-222, 604)

Zelandobatella naias Hopkins, 1975. Jour. Royal Soc. New Zealand, 5: 9.

Male: Integument soft, with characteristic large, slightly raised areas which are better illustrated (fig. 604) than described; length of body $479\mu\text{m}$ - $486\mu\text{m}$; dorsal sclerites consisting of small paired postocularia platelets and three pairs of small lateral sclerites (fig. 220); length between anterior end of first coxae and posterior end of genital field $342\mu\text{m}$ - $350\mu\text{m}$; first coxae separated medially; epimeroglandularia 1 fused with the second coxae; medial margins of posterior coxal group short and widely separated medially; glands of the fourth coxae located near suture lines between third and fourth coxae; genital field $76\mu\text{m}$ - $93\mu\text{m}$ in length, $100\mu\text{m}$ - $111\mu\text{m}$ in width; gonopore $52\mu\text{m}$ - $57\mu\text{m}$ in length, $26\mu\text{m}$ - $29\mu\text{m}$ in width; three pairs of genital acetabula; one pair of small muscle attachment platelets far laterally on venter (fig. 219); dorsal lengths of the palpal segments: P-I, $19\mu\text{m}$ - $21\mu\text{m}$; P-II, $61\mu\text{m}$ - $66\mu\text{m}$; P-III, $67\mu\text{m}$ - $71\mu\text{m}$; P-IV, $81\mu\text{m}$ - $88\mu\text{m}$; P-V, $43\mu\text{m}$ - $45\mu\text{m}$; papillae present only on P-III; figure 214 illustrates the proportions and chaetotaxy of the palp; capitulum $123\mu\text{m}$ - $137\mu\text{m}$ in length; chelicera $133\mu\text{m}$ - $141\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $81\mu\text{m}$ - $92\mu\text{m}$; I-Leg-5, $81\mu\text{m}$ - $94\mu\text{m}$; I-Leg-6, $83\mu\text{m}$ - $91\mu\text{m}$; these segments as shown for the female; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $108\mu\text{m}$ - $125\mu\text{m}$; IV-Leg-5, $104\mu\text{m}$ - $125\mu\text{m}$; IV-Leg-6, $107\mu\text{m}$ - $118\mu\text{m}$; swimming hairs absent.

Female: Integument as described and shown for male; length of body $502\mu\text{m}$ - $577\mu\text{m}$; dorsal sclerites as described and illustrated for male; length between anterior end of first coxae and posterior end of genital field $440\mu\text{m}$ - $509\mu\text{m}$; the venter, except for genital field region, as described for male; genital field $189\mu\text{m}$ - $200\mu\text{m}$ in width; length between anterior end of pregenital sclerite and posterior end of postgenital sclerite $133\mu\text{m}$ - $162\mu\text{m}$; three pairs of genital acetabula; figure 222 shows the structure of the venter; dorsal lengths of the palpal segments: P-I, $18\mu\text{m}$ - $24\mu\text{m}$; P-II, $83\mu\text{m}$ - $100\mu\text{m}$; P-III, $87\mu\text{m}$ - $104\mu\text{m}$; P-IV, $111\mu\text{m}$ - $130\mu\text{m}$; P-V, $50\mu\text{m}$ - $58\mu\text{m}$; ventral side of P-III with a few papillae; capitulum $151\mu\text{m}$ - $192\mu\text{m}$ in length; chelicera $166\mu\text{m}$ - $225\mu\text{m}$ in length; figure 221 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $96\mu\text{m}$ - $118\mu\text{m}$; I-Leg-5, $100\mu\text{m}$ - $115\mu\text{m}$; I-Leg-6, $94\mu\text{m}$ - $106\mu\text{m}$; figure 217 shows these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $130\mu\text{m}$ - $155\mu\text{m}$; IV-Leg-5, $131\mu\text{m}$ - $155\mu\text{m}$; IV-

Leg-6, 134 μ m-154 μ m; swimming hairs absent.

Material Examined: NORTH ISLAND: 2 σ , 1 φ , Te Whaiiau Stream at junction of Rt 47 and Rotoaria Rd, June 5, 1981; SOUTH ISLAND: 2 σ , 1 φ , from a tributary of the Whangamoa River on Rt 6, slightly west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 6, 1982; 36 φ , from mosses in a small waterfall seepage entering Graham Stream, on Rt 6 at picnic grounds 8 km northeast of Whangamoa Saddle, Nov. 6, 1982; 4 φ , tributary of the Motupiko River on Rt 6, between Korere and Glenhope, Nov. 7, 1982; 1 σ , Kararoa Creek on Rt. 6, between Barrytown and Nine Mile Village, Nov. 8, 1982; 3 φ , from Rocky Gully Stream on Rt 8, between Cave and Fairlie (west of Timaru), Nov. 18, 1982; 1 φ , Kaituna River on Rt 6, 5 km south of Havelock, Nov. 22, 1982; 1 σ , 3 φ , from a small creek on Rt 6, approx. 10 km west of Havelock, Nov. 22, 1982.

Family PIONIDAE Thor

Genus PIONA Koch

39. Piona exigua Viets

(Figs. 228, 230, 232-235)

Piona uncata exigua Viets, 1949. Abh. naturw. Ver. Bremen, 32: 322.

Piona novae-zealandiae Stout, 1953. Trans. Royal Soc. New Zealand, 81: 433.

Male: Length of body approximately 623 μ m; length between anterior end of first coxae and posterior end of genital field 570 μ m; first coxae separated and with short medial margins; epimeroglandularia 1 free; tips of first coxae not extending anterior to the capitulum; posterior coxal groups fused medially; suture lines between third and fourth coxae incomplete but extending nearly to median coxal margins; posterior apodemes of anterior coxal groups short; posterior corners of fourth coxae projecting and these projections nearly touching the genital field; genital field broadly fused with the fourth coxae; genital field extending laterally beyond projections of fourth coxae; genital field 318 μ m in width; a well developed genital pit present immediately posterior to the gonopore, width of this pit 125 μ m; 12-14 genital acetabula on each side; epimeroglandularia 2 free; figure 235 illustrates the venter; dorsal lengths of the palpal segments: P-I, 44 μ m; P-II, 174 μ m; P-III, 76 μ m; P-IV, 192 μ m; P-V, 91 μ m; two well developed setal tubercles on ventral side of P-IV; peg-like seta of P-IV distoventral; figure 232 shows the proportions and chaetotaxy of the palp; capitulum including the anchoral process 185 μ m in length, 162 μ m in width; chelicera 236 μ m in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 199 μ m; I-Leg-5, 238 μ m; I-Leg-6, 207 μ m; figure 234 shows I-Leg-5 and 6; dorsal lengths of the distal segments of the third leg: III-Leg-4, 185 μ m; III-Leg-5, 288 μ m; III-Leg-6, 140 μ m; III-Leg-6 expanded distally; a patch of short swimming hairs near the distal end of III-Leg-5; modification of the claws of the third leg better illustrated (fig. 233) than described; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 200 μ m; IV-Leg-5, 273 μ m; IV-Leg-6, 229 μ m; a group of stiff swimming hairs at distal end of IV-Leg-5; figure 230 shows the modification of IV-Leg-4.

Female: See Stout (1953b).

Material Examined: 1 φ , Lake Ianthe, on Rt 6, between Pukekura and Evans Creek, Nov. 9, 1982.

Discussion: This New Zealand mite was originally described as a subspecies of *uncata* but, when one examines the differences in male genital fields and considers the very disjunct distribution, it seems far more likely *exigua* should stand as a distinct species. Actually, *P. exigua* seems most closely related to the Australian species, *P. uncatiformis*, described by Lundblad (1947). The most noticeable difference between the two Australasian species is the proportionally wider genital pit and less laterally extending acetabular plates in males of the Australian species. The genital field only extends to the projections of the fourth coxae in *uncatiformis*, not well beyond them as in the present species (fig. 235). Although the *uncata*-like species of *Piona* are primarily holarctic, a member of the group, *P. pseudouncata*, was described by Piersig (1906) from Java. Although *pseudouncata* and *exigua* differ in morphology of the claws of the third leg, the two are sufficiently alike that Walter (1929) listed material sent to him from the Christchurch area of New Zealand (and very likely is actually *exigua*) as Piersig's species. It seems almost certain that members of this highly vagile species group of *Piona* have dispersed southwards into both New Zealand and Australia.

Family ATURIDAE Thor

Subfamily NOTOATURINAE Besch

Members of this austral subfamily are the only aturids presently known from New Zealand. However, they have undergone extensive evolution into many distinctive genera, and make up approximately one-half of the stream inhabiting species of the islands. Based on present knowledge of the notoaturin faunas of New Zealand, Australia, austral South America and southern Africa (unfortunately, members of the subfamily from the latter two regions are still very poorly known), each of these former Gondwanan areas contains a distinctive group. Noticeable differences are found in the number of dorsal sclerites and number of glandularia associated with the dorsal shield, and these seem to be relatively stable for the species living in each of the four areas. The discussions and diagnoses given below are by region in which the notoaturins occur.

SOUTHERN AFRICA: Two species assigned to the genus *Masabania* were collected in the Mt. Elgon region on the border between Kenya and Uganda. Although these are the only African notoaturins presently known, it is almost certain that additional species occur farther south. *Masabania* possesses an undivided anteromedial plate and an undivided posteromedial plate. These are flanked by three pairs of small lateral platelets, each of which bears a glandularium. The posteromedial plate bears one pair of glandularia bringing the number of dorsal glandularia to four pairs. Glands are absent on the fourth coxae as are projections associated with the openings for insertion of the fourth legs. These two structures are present in notoaturins from the other three land areas.

SOUTH AMERICA: One specimen of *Notoaturus*, *N. leptoglyphus* Besch, has been collected in austral Chile and is the only undoubted notoaturin so far collected in the New World. I examined Besch's slide preparation many years ago at a time when I did not know what to look for in the way of arrangement of the dorsal glandularia. It is very difficult to see the glandularia in the rugose integument of this Chilean species and am suspicious of the arrangement of these structures as illustrated by both Besch (1964) and Cook (1974). However, the very distinctive arrangement of the dorsal sclerites can be described. The anteromedial plate is divided into separate right and left parts. The posteromedi-

al plate is entire and there are two pairs of rather large lateral platelets. A pair of free glandularia sclerites (as commonly found in the New Zealand species) are present but, unlike their position in the New Zealand forms, they are close together medially anterior to the posteromedial plate in *Notoaturus*. I mentioned that *Notoaturus* was the only undoubted notoaturin presently known from South America. However, if one disregards the fact that it bears only four pairs of acetabula arranged in an "axonopsin" fashion, and looks instead at the arrangement of the plates and platelets of the dorsum, the austral genus and species *Notaxona ochiepus* Besch seems to be closely related to, if not actually a member of, the subfamily Notoaturinae.

AUSTRALIA: One species each in two genera, *Austraturus tumidipalpis* and *Barwontius inflatipalpis*, described by Kurt O. Viets (1978a, 1978b), are now listed from Australia, but at least 25 species are now known to occur there. All of the notoaturins of this continent have six pairs of glandularia associated with the dorsal shield, three pairs on the posteromedial plate, two pairs on the anterolateral platelet and one pair on the posterolateral platelets. The anteromedial plate is usually divided into right and left portions but in one unusual undescribed interstitial genus the anteromedial plate is entire.

NEW ZEALAND: Forty five species are presently known, most of which are treated in this paper. There are a constant number of plates and platelets on the dorsum; a single anteromedial plate, a single posteromedial plate and two pairs of lateral platelets. There are typically four pairs of glandularia associated with the dorsal shield but these can be variable in how they fuse with the dorsal sclerites. Most commonly there are a pair of glandularia on the anterolateral platelets, a pair on small sclerites lying free in the integument between the lateral platelets and the posteromedial plate (and here termed glandularia 2), and two pairs of glandularia on the posteromedial plate (fig. 254). However, these "free" glandularia may fuse with the anterolateral platelets (fig. 236), fuse with the posterolateral platelets (fig. 500), fuse with the posteromedial plate (fig. 289) or disappear (fig. 343).

The New Zealand notoaturins are extremely varied and appear to be the end products of an evolutionary radiation which has left few intermediates. Although most of the species can be placed in groups of related genera based on synapomorphisms, the relationships of these groups to each other is presently unclear. I believe an examination of all extant notoaturins, especially additional material from southern Africa, will be necessary in order to determine what is primitive and what is derived in the major notoaturin groups. For the New Zealand members of the subfamily, however, it is tempting to speculate that a condition in which there are a pair of "free" glandularia on the dorsum is plesiomorphic. It is easiest to derive the other arrangements of the dorsal glandularia from this condition. Also, the austral South American genus *Notoaturus* exhibits a similar set of "free" glandularia and one of the three lateral glandularia pairs in the African *Masabania* is likely its homolog.

Photographs of the dorsal shields are included for most of the New Zealand species. As the dorsal shield is convex, it is not possible to bring all areas into sharp focus at the same time. Also, certain surface features are important as well as those deeper in the integument. For these reasons, each photo is taken at a level which best illustrates the maximum number of taxonomically important characters and these characters often appear in only a limited area of the photograph, even though they are actually present over the entire dorsal shield. For example, the entire outer surface of the dorsal shield of *Taintaturus abditus* is reticulate as shown only around the periphery in the photograph (fig. 563).

1. IV-Leg-2 longer than other segments of the leg; IV-Leg-3 very small, partially covered by IV-Leg-2, reduced nearly to a point ventrally and this point bearing two setae (figs. 247, 264); antero-medial portion of ventral shield typically produced into a hood covering the capitular bay (figs. 249, 261), but in one species (fig. 286) this hood is greatly reduced 2
IV-Leg-2 not longer than other segments of this leg; IV-Leg-3 a more "typical" segment (i.e., not as shown in figure 247); anteromedial portion of ventral shield not typically produced into a hood over the capitular bay 5
2. Glandularia 2 of dorsum on small sclerites lying free in the integument (fig. 261) 3
Glandularia 2 of dorsum fused with the anterolateral platelets (fig. 236); no "free" glandularia present
Genus Planaturus, new genus ... (p. 52)
3. IV-Leg-2 laterally compressed but expanded dorsoventrally, and generally covering ventral projection of IV-Leg-3 (figs. 260, 264); anteromedial projection on dorsal side of ventral shield well developed (fig. 261); palpal segments relatively short 4
IV-Leg-2 only slightly compressed or expanded dorsoventrally, and not covering ventral projection of IV-Leg-3 (fig. 287); without a pronounced anteromedial projection on ventral shield; palpal segments greatly lengthened (fig. 283)
Genus Omegaturus, new genus .. (p. 62)

4. Very large, pointed projections associated with openings for insertion of fourth legs (fig. 276); capitulum much longer than high (fig. 282) and attached to a tube of soft integument to produce protrusible mouth parts Genus Abelaturus, new genus ... (p. 61)
Projections associated with openings for insertion of fourth legs much smaller (figs. 257, 273); capitulum only slightly longer than high (fig. 262) and not protrusible
Genus Taintaturus, new genus ... (p. 55)
5. Glandularia 2 of dorsum fused with the anterolateral platelets (figs. 425, 428) Genus Kritaturus, new genus 6
Glandularia 2 of dorsum variable in position but not fused with the anterolateral platelets 7
6. Males with a cauda and the posteromedial plate is highly modified (figs. 425, 433); fourth leg of male exhibiting sexual dimorphism (fig. 444) Subgenus Caudaturus, new subgenus .. (p. 95)
Males without a cauda and posteromedial plate is unmodified; no pronounced sexual dimorphism of male fourth leg
Subgenus Kritaturus (p. 95)
7. Glandularia 2 of dorsum fused with posteromedial plate (i.e., there are three pairs of glandularia on this plate --figure 289)
Genus Tryssaturopsis Cook(p. 64)
Glandularia 2 variable in position but not present on posteromedial plate (i.e., this plate bears two pairs of glandularia) 8
8. Anteromedial plate only slightly more than one-fourth as long as posteromedial plate; male gonopore located far forward on the body; genital acetabula described as being absent
Genus Zelandopsis Imamura
Anteromedial plate more than one-half as long as posteromedial plate; male gonopore more nearly terminal (figs. 388, 410); genital acetabula present 9
9. "Free" glandularia 2 sclerites nearly always absent from the dorsum; either this glandularia pair fused with the posterolateral platelets or absent; If present, as on one side in one of the known specimens belonging to the genus (fig. 338), with all three of the following characters: (1) insertions of fourth legs covered by projections which are truncate (fig. 337); (2) no sharp papillae on the ventral side of P-II; (3) excretory pore on a large terminal tubercle (fig. 338) 10
Glandularia 2 of the dorsum on small, "free" sclerites which touch the posteromedial plate and both the anterolateral and posterolateral platelets (figs. 308, 384); without a combination of all three characters given above..... 12

10. Glandularia either present on the posterolateral platelets (fig. 500) or, if absent, there are large setae on these platelets which are the homologs of the glandularia (figs. 485, 490); dorsum relatively smooth (figs. 600, 601) 11
Without glandularia or setae on the posterolateral platelets (figs. 338, 343); dorsum rugose (figs. 576, 577)
Genus Evidaturus, new genus(p. 85)
11. Gland portion of glandularia present on posterolateral platelets (fig. 500); leg segments laterally compressed but dorsoventrally expanded (figs. 503, 505); insertions of fourth legs well medial to lateral edge of ventral shield (fig. 501)
Genus Zelandalbia Imamura(p. 111)
Gland portion of glandularia absent on posterolateral platelets (fig. 485); leg segments not noticeably expanded or compressed; fourth legs inserted laterally (fig. 482)
Genus Uralbia Hopkins(p. 107)
12. Anterodorsal portion of ventral shield tapering to a well developed medial point (figs. 418, 421); openings for insertion of fourth legs with broad, truncate projections (figs. 410, 416); excretory pore ventral in position; male IV-Leg-5 expanded distally but not extending far beyond insertions of IV-Leg-6 (figs. 407, 426)
Genus Paratryssaturus Imamura ... (p. 90)
Anterodorsal portion of ventral shield generally more or less truncate medially (fig. 376) or actually indented (fig. 308);
(Note: do not confuse dorsal portion of ventral shield with the projecting roof of the camerostome. Figure 403 illustrates a more or less truncate anterodorsal portion of the ventral shield and a decidedly pointed roof of the camerostome); If anterodorsal portion of ventral shield is slightly pointed medially (fig. 360), the excretory pore is terminal or dorsal 13
13. Posterior suture lines of fourth coxae extending decidedly posteromedially (figs. 309, 313); glands of the fourth coxae greatly reduced in size; postocularia and all four pairs of glandularia of the dorsum on well developed tubercles (fig. 308)
Genus Pilosaturus, new genus ... (p. 69)
Posterior suture lines of fourth coxae extending more or less at right angles to long axis of body (figs. 316, 320) or slightly anteromedially (fig. 318); glands of the fourth coxae not reduced in size; postocularia and the four pairs of dorsal glandularia not all on tubercles 14
14. IV-Leg-1 shorter than IV-Leg-2; distinct intercoxal slots for legs present (figs. 358, 361); P-IV bulging ventrally, P-II with sharp-pointed papillae ventrally (figs. 351, 359); edges of projections associated with insertions of fourth legs without several setae on them (fig. 349) Genus Piotaturus, new genus(p. 88)

IV-Leg-1 longer than IV-Leg-2; no intercoxal slots for legs; P-IV of nearly the same height along entire length of segment; palpillae of ventral side of P-II small and bluntly pointed or absent; edges of projections associated with insertions of fourth legs with several setae (figs. 316, 320, 365) 15

15. Glands of the fourth coxae placed near middle of fourth coxae (figs. 316, 324); none of the genital acetabula doubled (two pore plates in the same cavity); male fourth legs with varying types of sexual dimorphism of the setae (figs. 317, 322, 327) 16

Glands of the fourth coxae placed near suture lines between the third and fourth coxae (fig. 382); typically with one set of anteriorly located, doubled acetabula (two pore plates in the same cavity -- figures 374, 603); males with no pronounced sexual dimorphism of the setae of the fourth legs (figs. 381, 404)

Genus Pseudotryssaturus, new genus ... (p. 75)

16. Dorsal shield as wide as, or nearly as wide as, long (figs. 329, 574); dorsal shield not reticulate in appearance (figs. 574, 575); male with a distinct cauda (figs. 320, 332)

Genus Neotryssaturus Cook (p. 72)

Dorsal shield much longer than wide (fig. 314); dorsal shield is reticulate in appearance (fig. 573); males without a distinct cauda (fig. 316) Genus Tryssaturus Hopkins (p. 71)

Genus PLANATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets bearing two pairs of glandularia and posteromedial plate bearing two pairs of glandularia; integument smooth (fig. 561); anterodorsal portion of ventral shield produced into a well developed hood which is more or less truncate anteriorly (fig. 236); a pair of glandularia immediately medial to insertions of the fourth legs; no pronounced sexual dimorphism of the legs; leg segments laterally compressed and high dorsoventrally; intercoxal slots present to house portions of these leg segments; IV-Leg-2 the longest segment of the fourth leg; IV-Leg-3 short, partially covered by IV-Leg-2 and its ventral portion reduced to an angle bearing two setae (fig. 247); projections associated with insertions of fourth legs relatively broad; P-IV wider than high (figs. 244, 250).

Type Species: *Planaturus setipalpis*, new species.

Discussion: The proximal portion of IV-Leg-1 is constricted and then widens out again at very end as shown in figure 255 for members of the present genus and the following three, *Taintaturus*, *Abelaturus* and *Omegaturus*. When the leg is removed it nearly always breaks at the point of constriction and, for this reason, true length measurements of this segment are nearly impossible to obtain.

Planaturus, along with the three genera mentioned in the above paragraph, form a natural genus group characterized by the tendency for IV-Leg-2 to become lengthened, laterally compressed and dorsoventrally expanded. IV-Leg-3 is reduced ventrally to more or less an angle bearing two setae (fig. 247). These characters are without doubt synapomorphic for this genus group. In *Omegaturus*, IV-Leg-2 is closer to the ancestral condition for the group (fig. 287) with little expansion or compression but IV-Leg-3 is typical for the group. Other characteristics are a tendency to form a hood at the anterior end of the dorsal

side of the ventral shield. Again, *Omegaturus* seems to be at the beginning of a transformation series in which the hood ranges from only slightly developed to well developed in the genera *Planaturus* and *Taintaturus*, especially in the former (figs. 236, 241). Other shared characteristics are a pair of glandularia located slightly posteromedial to the insertions of the fourth legs and well developed intercoxal slots. What appear to be the most primitive of these four genera based on the characters listed above, *Omegaturus* and *Abelaturus*, exhibit the most highly modified mouthparts, but this is likely a derived condition.

The fusion of the "free" glandularia with the anterolateral platelets will easily separate the present genus from other members of its group.

40. Planaturus setipalpis, new species

(Figs. 236-243, 561)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $502\mu\text{m}$ ($516\mu\text{m}$ - $547\mu\text{m}$) in length, $380\mu\text{m}$ ($349\mu\text{m}$ - $395\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with two pairs of glandularia and the posteromedial plate bearing two pairs of glandularia; anterodorsal portion of ventral shield forming a broad projecting hood; integument smooth and with small pores (figure 561); figure 236 illustrates a dorsal view of the body; ventral shield $714\mu\text{m}$ ($729\mu\text{m}$ - $745\mu\text{m}$) in length, $456\mu\text{m}$ ($441\mu\text{m}$ - $500\mu\text{m}$) in width; second and third coxae pointed and somewhat projecting; intercoxal slots present between first and second coxae, second and third coxae and third and fourth coxae; projections associated with insertions of fourth legs relatively wide; a pair of glandularia located immediately medial to these projections; male gonopore small and nearly terminal; numerous small setae surrounding gonopore; ventral shield with a projection posterior to the gonopore; several pairs of genital acetabula present; dorsal lengths of the palpal segments: P-I, $13\mu\text{m}$ ($13\mu\text{m}$ - $16\mu\text{m}$); P-II, $28\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); P-III, $29\mu\text{m}$ ($26\mu\text{m}$ - $31\mu\text{m}$); P-IV, $36\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); P-V, $17\mu\text{m}$; P-II noticeably humped dorsally and bearing a medial thickened seta approximately $50\mu\text{m}$ in length (fig. 238); capitulum $86\mu\text{m}$ ($80\mu\text{m}$ - $86\mu\text{m}$) in length; anterodorsal portion of capitulum blunt and only slightly projecting; chelicera $86\mu\text{m}$ ($79\mu\text{m}$ - $83\mu\text{m}$) in length; all distal leg segments tending to be high and laterally compressed; dorsal lengths of the distal segments of the first leg: I-Leg-4, $45\mu\text{m}$ ($42\mu\text{m}$ - $46\mu\text{m}$); I-Leg-5, $41\mu\text{m}$ ($41\mu\text{m}$ - $42\mu\text{m}$); I-Leg-6, $36\mu\text{m}$ ($38\mu\text{m}$ - $41\mu\text{m}$); height of I-Leg-5, $29\mu\text{m}$ ($30\mu\text{m}$ - $31\mu\text{m}$); proportions of these segments as illustrated for the female; dorsal lengths of the segments of the fourth leg: IV-Leg-2, $62\mu\text{m}$ ($62\mu\text{m}$ - $76\mu\text{m}$); IV-Leg-3, $24\mu\text{m}$ ($26\mu\text{m}$ - $28\mu\text{m}$); IV-Leg-4, $35\mu\text{m}$ ($36\mu\text{m}$ - $37\mu\text{m}$); IV-Leg-5, $35\mu\text{m}$ ($33\mu\text{m}$ - $36\mu\text{m}$); IV-Leg-6, $52\mu\text{m}$ ($45\mu\text{m}$ - $50\mu\text{m}$); greatest height of IV-Leg-2, $41\mu\text{m}$ ($40\mu\text{m}$ - $43\mu\text{m}$); swimming hairs absent.

Female: Dorsum as described for the male; dorsal shield $562\mu\text{m}$ ($532\mu\text{m}$ - $577\mu\text{m}$) in length, $380\mu\text{m}$ ($364\mu\text{m}$ - $410\mu\text{m}$) in width; ventral shield $744\mu\text{m}$ ($715\mu\text{m}$ - $775\mu\text{m}$) in length, $441\mu\text{m}$ ($426\mu\text{m}$ - $486\mu\text{m}$) in width; except for genital field area, ventral shield as described for male, although tending to be proportionally somewhat narrower; gonopore terminal (fig. 241); female lacks the medial projection at posterior end of ventral shield; dorsal lengths of the palpal segments: P-I, $12\mu\text{m}$ ($13\mu\text{m}$ - $14\mu\text{m}$); P-II, $29\mu\text{m}$ ($28\mu\text{m}$ - $33\mu\text{m}$); P-III, $22\mu\text{m}$ ($23\mu\text{m}$ - $26\mu\text{m}$); P-IV, $34\mu\text{m}$ ($33\mu\text{m}$ - $35\mu\text{m}$); P-V, $17\mu\text{m}$; P-II not as humped dorsally and medial seta not as expanded as in male (fig. 240); capitulum $76\mu\text{m}$ ($72\mu\text{m}$ - $83\mu\text{m}$) in length; chelicera $79\mu\text{m}$ ($83\mu\text{m}$ - $89\mu\text{m}$) in length; figure 242 shows the structure

of the capitulum and chelicera; legs not exhibiting sexual dimorphism and are as described for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4, $38\mu\text{m}$ ($35\mu\text{m}$ - $37\mu\text{m}$); I-Leg-5, $36\mu\text{m}$ ($36\mu\text{m}$ - $39\mu\text{m}$); I-Leg-6, $38\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); figure 237 shows the distal segments of the first leg; the dorsal lengths of the segments of the fourth leg: IV-Leg-2, $65\mu\text{m}$ ($62\mu\text{m}$ - $65\mu\text{m}$); IV-Leg-3, $27\mu\text{m}$ ($24\mu\text{m}$ - $26\mu\text{m}$); IV-Leg-4, $31\mu\text{m}$ ($31\mu\text{m}$ - $33\mu\text{m}$); IV-Leg-5, $31\mu\text{m}$ ($30\mu\text{m}$ - $31\mu\text{m}$); IV-Leg-6, $41\mu\text{m}$ ($41\mu\text{m}$ - $44\mu\text{m}$); greatest height of IV-Leg-2, $34\mu\text{m}$ ($31\mu\text{m}$ - $35\mu\text{m}$); swimming hairs absent.

Holotype: Adult ♂, headwaters of Whangamata Stream, 10 km northwest of Taupo, North Island, Nov. 3, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 1 ♂, 1 ♀, same data as holotype; SOUTH ISLAND: 9 ♂, 6 ♀, from a tributary of the Wakamarina River 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 5 ♀, Oaro River at Oaro, on Rt 1 approx. 20 km south of Kaikoura, Nov. 19, 1982; 3 ♀, Pariwhakaoho River on Rt 60, 14 km northwest of Takaka, Nov. 24, 1982.

Discussion: As there are only two known species in this genus, no key is given. See remarks under the following species for characteristics which will separate the two.

41. Planaturus lundbladi, new species

(Figs. 244-251)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $570\mu\text{m}$ ($540\mu\text{m}$ - $608\mu\text{m}$) in length, $410\mu\text{m}$ ($388\mu\text{m}$ - $471\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with two pairs of glandularia and the posteromedial plate with two pairs of glandularia; dorsal sclerites smooth and with small pores as shown for the preceding species (fig. 561); anteromedial portion of ventral shield forming a broad, projecting hood; ventral shield $775\mu\text{m}$ ($782\mu\text{m}$ - $851\mu\text{m}$) in length, $532\mu\text{m}$ ($536\mu\text{m}$ - $592\mu\text{m}$) in width; second and third coxae pointed and somewhat projecting; intercoxal slots present; projections associated with insertions of fourth legs relatively wide; a pair of glandularia located medial to these projections; gonopore small and terminal; a medially located group of small setae extending anteriorly from gonopore (fig. 251); no medial projection present posterior to gonopore; several genital acetabula present on each side; dorsal lengths of the palpal segments: P-I, $14\mu\text{m}$ ($15\mu\text{m}$ - $17\mu\text{m}$); P-II, $31\mu\text{m}$ ($32\mu\text{m}$ - $34\mu\text{m}$); P-III, $24\mu\text{m}$ ($25\mu\text{m}$ - $29\mu\text{m}$); P-IV, $41\mu\text{m}$ ($40\mu\text{m}$ - $42\mu\text{m}$); P-V, $17\mu\text{m}$ ($17\mu\text{m}$ - $18\mu\text{m}$); P-II noticeably humped dorsally; none of the setae of P-II greatly lengthened or expanded (fig. 244); capitulum $97\mu\text{m}$ ($104\mu\text{m}$ - $107\mu\text{m}$) in length; anterodorsal portion of capitulum with a pronounced projection (fig. 246); chelicera $93\mu\text{m}$ ($93\mu\text{m}$ - $97\mu\text{m}$) in length; all the distal leg segments tending to be high and laterally compressed; dorsal lengths of the distal segments of the first leg: I-Leg-4, $45\mu\text{m}$ ($44\mu\text{m}$ - $45\mu\text{m}$); I-Leg-5, $40\mu\text{m}$ ($41\mu\text{m}$ - $42\mu\text{m}$); I-Leg-6, $41\mu\text{m}$ ($41\mu\text{m}$ - $44\mu\text{m}$); greatest height of I-Leg-5, $28\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-2, $76\mu\text{m}$ ($83\mu\text{m}$ - $86\mu\text{m}$); IV-Leg-3, $35\mu\text{m}$ ($34\mu\text{m}$ - $36\mu\text{m}$); IV-Leg-4, $37\mu\text{m}$ ($39\mu\text{m}$ - $41\mu\text{m}$); IV-Leg-5, $35\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); IV-Leg-6, $51\mu\text{m}$ ($51\mu\text{m}$ - $52\mu\text{m}$); greatest height of IV-Leg-2, $48\mu\text{m}$ ($51\mu\text{m}$ - $55\mu\text{m}$); figure 247 illustrates the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for male; dorsal shield $532\mu\text{m}$ in length, $380\mu\text{m}$ in width; ventral shield $744\mu\text{m}$ in length, $471\mu\text{m}$ in width; except for genital

field area, ventral shield as described for male, but not as narrowed in posterior half; gonopore terminal (fig. 248); a few genital acetabula on each side; dorsal lengths of the palpal segments: P-I, $14\mu\text{m}$; P-II, $31\mu\text{m}$; P-III, $23\mu\text{m}$; P-IV, $35\mu\text{m}$; P-V, $16\mu\text{m}$; P-II not as humped dorsally as in male (fig. 245); capitulum $83\mu\text{m}$ in length and with an anterodorsal protuberance as in male; chelicera $97\mu\text{m}$ in length; legs not exhibiting sexual dimorphism and as described and illustrated for male; dorsal lengths of the distal segments of the first leg: I-Leg-4, $35\mu\text{m}$; I-Leg-5, $36\mu\text{m}$; I-Leg-6, $36\mu\text{m}$; greatest height of I-Leg-5, $24\mu\text{m}$; structure of first leg similar to that shown for the related species (fig. 237); dorsal lengths of the segments of the fourth leg: IV-Leg-2, $62\mu\text{m}$; IV-Leg-3, $27\mu\text{m}$; IV-Leg-4, $30\mu\text{m}$; IV-Leg-5, $31\mu\text{m}$; IV-Leg-6, $43\mu\text{m}$; greatest height of IV-Leg-2, $39\mu\text{m}$.

Holotype: Adult ♂, from a stream on Wainui Rd, 5 km west of Mahinepua Rd, northern North Island, Oct. 22, 1982

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 5 ♂, from Waima River on Rt. 12, 7 km west of Taheke, Oct. 24, 1982; 1 ♂, from a stream at Twin Bridges, near Nukuta-whiti, May 30, 1981.

Discussion: The present species differs from *P. setipalpis* in lacking the enlarged setae on P-II (compare figures 238, 240 with figures 244, 245) and the protuberance on the distodorsal portion of the capitulum is more pointed (compare figures 242, 246). In addition, males of *lundbladi* lack a medial projection posterior to the gonopore but do have a group of small setae extending anterior to the gonopore (compare figures 243, 251).

Genus TAINTATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets bearing one pair of glandularia; a pair of very small glandularia sclerites between medial corners of the anterolateral and posterolateral platelets and the lateral edge of posteromedial plate; posteromedial plate bearing two pairs of glandularia; dorsal sclerites variously reticulate or irregularly lined (figs. 562-565); anterodorsal portion of ventral shield produced into a somewhat pointed hood which generally does not extend anteriorly as far as tips of coxae; coxal slots well developed; projections associated with insertions of fourth legs truncate and of moderate size (figs. 266, 269); a pair of glandularia located immediately medial to insertions of fourth legs; no pronounced sexual dimorphism of the legs; leg segments laterally compressed and high dorsoventrally; IV-Leg-2 is largest segment of fourth leg; IV-Leg-3 short, partially covered by IV-Leg-2 and its ventral portion reduced to a median angle bearing two setae (fig. 255); capitulum with an anchoral process and is not protrusible; P-IV wider than high (this means that only a slight difference in orientation of palp on slide will result in great apparent variations in height of segment).

Type Species: *Taintaturus hopkinsi*, new species.

Discussion: The present genus is most closely related to *Planaturus* but differs in having a pair of "free" glandularia on the dorsum, a less well developed anterodorsal hood and the integument tends to be more rugose. In some of the species the integument may be so irregular that the genital acetabula are difficult to see. Figure 266 shows what could be discerned from an examination of several individuals mounted on slides. However, a scanning EM photograph in posterior view (fig. 602) shows there are generally three rows of acetabula. Note that the pore plates are so deep, and cavities lacking pore plates so similar to those that do have them, that most acetabula cannot be determined with

certainty in ventral view.

KEY TO THE NEW ZEALAND SPECIES OF TAINTATURUS

1. Anteromedial and posteromedial plates with numerous pores but no obvious reticulate ornamentation (fig. 565)
Taintaturus projectus, new species(p. 60)
 Anteromedial and posteromedial plates with a distinct reticulate pattern (figs. 562-564) 2
2. Projections associated with insertions of fourth legs moderately wide, with the lateral margins gradually tapering (figs. 266, 268); ornamentation of dorsal sclerites consisting of reticulations on surface and a stellate appearance deeper into the integument (fig. 562); IV-Leg-2 very high (fig. 264); male gonopore simple (fig. 268) Taintaturus hopkinsi, new species(p. 56)
 Projections associated with insertions of fourth legs less wide and with lateral margins extending straight forward or even somewhat anteromedially (figs. 257, 259); ornamentation of the dorsal sclerites consisting of surface reticulations but not a stellate appearance deeper in integument (figs. 563, 564); IV-Leg-2 of moderate height (figs. 255, 260); male gonopore region modified (figs. 252, 259) 3
3. Male genital field with a small median pit partially covered by a posteriorly directed projection located anterior to the gonopore (fig. 252)..... Taintaturus abditus, new species(p. 58)
 Male genital field without a median pit anterior to the gonopore (fig. 259)..... Taintaturus accidens, new species(p. 58)

42. Taintaturus hopkinsi, new species

(Figs. 262, 264-268, 271, 562, 602)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $319\mu\text{m}$ ($289\mu\text{m}$ - $319\mu\text{m}$) in length, $243\mu\text{m}$ ($243\mu\text{m}$ - $274\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; one pair of glandularia on small sclerites lying free; posteromedial plate with two pairs of glandularia; ornamentation of the dorsal shield consisting of surface reticulations which are not arranged in rows and deeper portions of integument appearing stellate (fig. 562); anteromedial portion of ventral shield forming a somewhat truncate hood which does not project as far forward as tips of coxae (fig. 265); ventral shield $449\mu\text{m}$ ($388\mu\text{m}$ - $471\mu\text{m}$) in length, $278\mu\text{m}$ ($278\mu\text{m}$ - $297\mu\text{m}$) in width; second and third coxae somewhat pointed; well developed intercoxal slots present; anterolateral corners of ventral shield exhibit varying degree of development of anterior projections (fig. 268), but absent in some individuals; projections associated with insertions of fourth legs relatively wide, the outer margins tapering; a pair of glands located medial to these projections; gonopore small, subterminal and flanked by a few setae (fig. 268); a few genital acetabula on each side; dorsal lengths of the palpal segments: P-I, $19\mu\text{m}$ ($19\mu\text{m}$ -

21 μ m); P-II, 36 μ m (34 μ m-38 μ m); P-III, 24 μ m (21 μ m-24 μ m); P-IV, 46 μ m (43 μ m-46 μ m); P-V, 18 μ m (19 μ m-21 μ m); structure of palp as shown for the female; capitulum 76 μ m (66 μ m-73 μ m) in length; chelicera 97 μ m (93 μ m-100 μ m) in length; all distal segments of the legs tending to be high and laterally compressed; dorsal lengths of the distal segments of the first leg: I-Leg-4, 41 μ m (35 μ m-41 μ m); I-Leg-5, 45 μ m (42 μ m-48 μ m); I-Leg-6, 27 μ m (24 μ m-28 μ m); greatest height of I-Leg-5, 28 μ m (24 μ m-26 μ m); dorsal lengths of the segments of the fourth leg: IV-Leg-2, 80 μ m (73 μ m-83 μ m); IV-Leg-3, 33 μ m (28 μ m-34 μ m); IV-Leg-4, 38 μ m (30 μ m-37 μ m); IV-Leg-5, 36 μ m (31 μ m-34 μ m); IV-Leg-6, 52 μ m (45 μ m-50 μ m); greatest height of IV-Leg-2, 62 μ m (52 μ m-69 μ m); figure 264 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for male; dorsal shield 327 μ m (304 μ m-334 μ m) in length, 265 μ m (251 μ m-274 μ m) in width; ventral shield 460 μ m (418 μ m-464 μ m) in length, 297 μ m (273 μ m-304 μ m) in width; except for genital field region, ventral shield as described for male; gonopore terminal (fig. 266); a few genital acetabula present on each side; dorsal lengths of the palpal segments: P-I, 19 μ m (17 μ m-21 μ m); P-II, 36 μ m (34 μ m-36 μ m); P-III, 22 μ m (21 μ m-23 μ m); P-IV, 44 μ m (43 μ m-45 μ m); P-V, 21 μ m (17 μ m-20 μ m); figure 271 shows the proportions and chaetotaxy of the palp; capitulum 69 μ m (69 μ m-72 μ m) in length and with a pronounced anterodorsal projection; chelicera 87 μ m (89 μ m-97 μ m) in length; figure 262 shows a lateral view of the capitulum and chelicera; legs not exhibiting sexual dimorphism and are as described and illustrated for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4, 43 μ m (35 μ m-41 μ m); I-Leg-5, 43 μ m (40 μ m-42 μ m); I-Leg-6, 50 μ m (45 μ m-48 μ m); greatest height of I-Leg-5, 27 μ m (24 μ m-28 μ m); figure 267 illustrates these segments; dorsal lengths of the segments of the fourth leg: IV-Leg-2, 79 μ m (73 μ m-76 μ m); IV-Leg-3, 31 μ m (24 μ m-28 μ m); IV-Leg-4, 31 μ m (29 μ m-34 μ m); IV-Leg-5, 31 μ m (28 μ m-31 μ m); IV-Leg-6, 52 μ m (45 μ m-49 μ m); greatest height of IV-Leg-2, 59 μ m (52 μ m-59 μ m).

Holotype: Adult σ , from the headwaters of Whangamata Stream, 10 km northwest of Taupo, North Island, Nov. 3, 1982.

Allotype: Adult φ , same data as holotype.

Paratypes: NORTH ISLAND: 4 σ , Kaeo River, on Waiare Rd 4 km south of junction with Rt 10, Oct. 21, 1982; 1 σ , from a stream on Wainui Rd, 5 km west of Mahinepua Rd, Oct. 22, 1982; 2 φ , tributary of Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 7 σ , 8 φ , Torere River at Torere, on Rt 35 north of Opotiki, Oct. 28, 1982; 2 σ , Waimana River in "Gorge", between Tameatura and Opotiki, Oct. 28, 1982; 1 φ , from a stream at Omaukoro Bridge, on Rt 2, in the "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 4 σ , 2 φ , from a tributary of the Wakamarina River, 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 2 φ , Shag River near its headwaters, on Rt 85, 2 km west of Pigroot Summit (Central Otago), Nov. 16, 1982; 2 σ , 1 φ , Rocky Gully Stream, on Rt 8 between Cave and Fairlie (west of Timaru), Nov. 18, 1982; 43 σ , 115 φ , Oaro River at Oaro, on Rt 1 approx. 20 km south of Kaidoura, Nov. 19, 1982; 5 φ , 20 φ , Irongate Stream on Rt 1, 24 km north of Kairoura, Nov. 21, 1982; 1 σ , 1 φ , Mororimu Stream on Rt 1, approx. 35 km north of Kaikoura, Nov. 21, 1982; 3 σ , 1 φ , Kaituna River on Rt 6, 5 km south of Havelock, Nov. 22, 1982; 2 φ , Graham Stream on Rt 6, at picnic grounds, 8 km northeast of Whangamoa Saddle, Nov. 23, 1982; 3 σ , Whangamoa River on Rt 6, approx. 5 km northeast of Whangamoa Saddle, Nov. 23, 1982; 2 φ , tributary of the Waitapu River at Paynes Ford, 3 km south of Takaka, Nov. 24, 1982.

Discussion: The present species exhibits the fewest derived character states

of any of the four species assigned to the genus. The males of *hopkinsi* have a simple gonopore region, no development of a cauda and none of the setae on I-Leg-4 are modified.

43. Taintaturus accidens, new species

(Figs. 256, 259-261, 263, 564)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $289\mu\text{m}$ in length, $228\mu\text{m}$ in width; anteromedial plate bearing the postocularia; the anterolateral platelets bearing one pair of glandularia; one pair of glandularia on small sclerites lying free; posteromedial plate with two pairs of glandularia; ornamentation of dorsal sclerites consisting of reticulations, some of which are arranged in irregular rows (fig. 564); anteromedial portion of ventral shield forming a dorsal hood which extends forward approximately to tips of first coxae (fig. 261); ventral shield $410\mu\text{m}$ in length, $273\mu\text{m}$ in width; first coxae blunt; second and third coxae somewhat pointed; well developed intercoxal slots present; projections associated with insertions of fourth legs blunt and with lateral margins curving slightly medially; a pair of glands lying somewhat medial to these projections; gonopore region modified, its morphology better illustrated (fig. 259) than described; a few genital acetabula on each side; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$; P-II, $37\mu\text{m}$; P-III, $29\mu\text{m}$; P-IV, $52\mu\text{m}$; P-V, $16\mu\text{m}$; ventral projection of P-III relatively long; figure 256 shows the proportions and chaetotaxy of the palp; capitulum $76\mu\text{m}$ in length; structure of capitulum much as shown in figure 262 but anterodorsal projection slightly larger and less pointed; chelicera $93\mu\text{m}$ in length; all except the most proximal segments of the legs high and laterally compressed; dorsal lengths of the distal segments of the first leg: I-Leg-4, $48\mu\text{m}$; I-Leg-5, $52\mu\text{m}$; I-Leg-6, $52\mu\text{m}$; greatest height of I-Leg-5, $36\mu\text{m}$; one of the two ventral setae on I-Leg-4 "normal", the other short, truncate and somewhat expanded distally (fig. 263); dorsal lengths of the segments of the fourth leg: IV-Leg-2, $88\mu\text{m}$; IV-Leg-3, $35\mu\text{m}$; IV-Leg-4, $43\mu\text{m}$; IV-Leg-5, $48\mu\text{m}$; IV-Leg-6, $58\mu\text{m}$; greatest height of IV-Leg-2, $41\mu\text{m}$; figure 260 shows the proportions and chaetotaxy of the fourth leg.

Female: Unknown.

Holotype: Adult ♂, from Adamson Creek on Rt. 6, between Lake Ianthe and Wanganui, South Island, Nov. 9, 1982.

Discussion: This species seems most closely related to the following. See remarks under the latter.

44. Taintaturus abditus, new species

(Figs. 252-255, 257, 258, 563)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $289\mu\text{m}$ ($288\mu\text{m}$ - $304\mu\text{m}$) in length, $224\mu\text{m}$ ($217\mu\text{m}$ - $232\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; one pair of glandularia on small sclerites lying free; posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield consisting of reticulations arranged in irregular rows and as one focuses downwards, a papillate appearance comes into view (fig. 563); anteromedial portion of ventral shield forming a somewhat pointed dorsal hood which does not extend to the tips of the first coxae (fig. 254); ventral shield $406\mu\text{m}$ ($395\mu\text{m}$ - $440\mu\text{m}$) in length, $274\mu\text{m}$

(258 μ m-282 μ m) in width; first coxae blunt; second and third coxae somewhat pointed; intercoxal slots well developed; projections associated with insertions of fourth legs truncate and with lateral margins more or less parallel to the median margins; a pair of glandularia placed somewhat medial to these projections; gonopore region modified, with a posterior cleft; a small concavity with a rounded, posteriorly directed projection located at anterior end of cleft; a few genital acetabula present on each side; morphology of genital field region better illustrated (fig. 252) than described; dorsal lengths of the palpal segments: P-I, 17 μ m (17 μ m-19 μ m); P-II, 34 μ m (35 μ m-38 μ m); P-III, 27 μ m (27 μ m-31 μ m); P-IV, 40 μ m (40 μ m-45 μ m); P-V, 19 μ m (20 μ m-22 μ m); figure 253 shows the proportions and chaetotaxy of the palp; capitulum 79 μ m (76 μ m-82 μ m) in length; capitulum similar to than shown in figure 262 but anterodorsal projection not as pointed; chelicera 96 μ m (94 μ m-107 μ m) in length; all except the most proximal leg segments relatively high and laterally compressed; dorsal lengths of the distal segments of the first leg: I-Leg-4, 45 μ m (44 μ m-48 μ m); I-Leg-5, 48 μ m (48 μ m-52 μ m); I-Leg-6, 45 μ m (43 μ m-51 μ m); greatest height of I-Leg-5, 31 μ m (31 μ m-35 μ m); one of the two ventral setae on I-Leg-4 "normal", the other expanded and serrate (fig. 258); dorsal lengths of the segments of the fourth leg: IV-Leg-2, 83 μ m (76 μ m-88 μ m); IV-Leg-3, 35 μ m (33 μ m-38 μ m); IV-Leg-4, 40 μ m (38 μ m-48 μ m); IV-Leg-5, 42 μ m (41 μ m-48 μ m); IV-Leg-6, 50 μ m (48 μ m-55 μ m); greatest height of IV-Leg-2, 42 μ m (41 μ m-46 μ m); figure 255 illustrates the fourth leg; in the fourth leg illustrated, the proximal portion of IV-Leg-1 did not break off during removal of the leg but, as mentioned earlier, it rarely survives dissection.

Female: Dorsum as described for the male; dorsal shield 293 μ m (284 μ m-304 μ m) in length, 232 μ m (228 μ m-232 μ m) in width; ventral shield 395 μ m (387 μ m-410 μ m) in length, 262 μ m (258 μ m-273 μ m) in width; except for genital field region, ventral shield as described for male; gonopore terminal; a few genital acetabula on each side (fig. 257); dorsal lengths of the palpal segments: P-I, 17 μ m (17 μ m-18 μ m); P-II, 35 μ m (33 μ m-35 μ m); P-III, 27 μ m (24 μ m-26 μ m); P-IV, 41 μ m (41 μ m-43 μ m); P-V, 18 μ m (18 μ m-19 μ m); capitulum 76 μ m (66 μ m-76 μ m) in length; chelicera 95 μ m (86 μ m-97 μ m) in length; structure of palp, capitulum and chelicera as described or illustrated for male; dorsal lengths of the distal segments of the first leg: I-Leg-4, 37 μ m (37 μ m-38 μ m); I-Leg-5, 41 μ m (40 μ m-42 μ m); I-Leg-6, 43 μ m (43 μ m-45 μ m); greatest height of I-Leg-5, 26 μ m-28 μ m; segments of first leg similar to those shown for the male but not quite as high and without the modified seta on I-Leg-4; dorsal lengths of the segments of the fourth leg: IV-Leg-2, 72 μ m (72 μ m-76 μ m); IV-Leg-3, 31 μ m (29 μ m-31 μ m); IV-Leg-4, 35 μ m (36 μ m-41 μ m); IV-Leg-5, 35 μ m (36 μ m-38 μ m); IV-Leg-6, 47 μ m (48 μ m-49 μ m); greatest height of IV-Leg-2, 34 μ m (35 μ m-38 μ m); female fourth leg similar to that of male.

Holotype: Adult σ , Whangamoia River on Rt 6, approx. 5 km northeast of Whangamoia Saddle, northern South Island, Nov. 23, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: SOUTH ISLAND: 2 σ , 1 f , Opouri River between Carluke and Opouri Valley, on Tennyson Inlet Rd, Nov. 6, 1982; 1 f , Graham Stream on Rt 6, at picnic grounds 8 km northeast of Whangamoia Saddle, Nov. 6, 1982; 2 σ , Adamson Creek on Rt 6, between Lake Ianthe and Wanganui, Nov. 9, 1982; 3 f , Potters Creek on Rt 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 3 f , same data as holotype.

Discussion: The present species and the preceding, *T. accidens*, are closely related, differing most noticeably in the more pronounced sexual dimorphism of

the genital field region in *abditus* (compare figures 252, 259). Also the modified setae on I-Leg-4 are different with the present species bearing the largest seta (compare figures 258, 263). These two species exhibit a more derived condition of the male genital field than in *hopkinsi*.

45. Taintaturus projectus, new species

(Figs. 269, 270, 272-275, 565)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $236\mu\text{m}$ ($234\mu\text{m}$ - $236\mu\text{m}$) in length, $192\mu\text{m}$ ($200\mu\text{m}$) in width; anteromedial plate with the postocularia; anterolateral platelets bearing a pair of glandularia; one pair of glandularia lying on small, free sclerites; posteromedial plate with two pairs of glandularia; ornamentation of the dorsal sclerites consisting of ill defined lines and small body pores as shown for the female (fig. 565); anteromedial portion of ventral shield with a somewhat pointed dorsal hood which does not extend nearly to the tips of the first coxae; cauda, when viewed dorsally, extending well posterior to excretory pore and bearing a pair of glandularia (fig. 275); ventral shield $355\mu\text{m}$ ($355\mu\text{m}$ - $359\mu\text{m}$) in length, $229\mu\text{m}$ ($222\mu\text{m}$ - $225\mu\text{m}$) in width; anterior three pairs of coxae more or less pointed; intercoxal slots well developed; projections associated with insertions of fourth legs truncate and moderately wide; a pair of glands located immediately lateral to these projections; gonopore terminal and located on a small cauda (fig. 273); gonopore surrounded by several small setae; a few genital acetabula on each side; dorsal lengths of the palpal segments: P-I, $13\mu\text{m}$; P-II, $34\mu\text{m}$ ($33\mu\text{m}$ - $35\mu\text{m}$); P-III, $20\mu\text{m}$ ($20\mu\text{m}$ - $21\mu\text{m}$); P-IV, $36\mu\text{m}$ ($35\mu\text{m}$ - $36\mu\text{m}$); P-V, $20\mu\text{m}$ ($18\mu\text{m}$ - $19\mu\text{m}$); palp similar to that shown for female; capitulum $69\mu\text{m}$ ($64\mu\text{m}$ - $67\mu\text{m}$) in length; chelicera $79\mu\text{m}$ ($83\mu\text{m}$) in length; structure of capitulum much as shown in figure 262 but anterodorsal projection is larger and more rounded; all except the most proximal leg segments high and laterally compressed; dorsal lengths of the distal segments of the first leg: I-Leg-4, $36\mu\text{m}$ ($34\mu\text{m}$ - $35\mu\text{m}$); I-Leg-5, $36\mu\text{m}$ ($35\mu\text{m}$ - $38\mu\text{m}$); I-Leg-6, $39\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); greatest height of I-Leg-5, $30\mu\text{m}$ ($29\mu\text{m}$ - $30\mu\text{m}$); structure of these segments as shown for the female; dorsal lengths of the segments of the fourth leg: IV-Leg-2, $61\mu\text{m}$ ($52\mu\text{m}$ - $62\mu\text{m}$); IV-Leg-3, $31\mu\text{m}$ ($28\mu\text{m}$ - $30\mu\text{m}$); IV-Leg-4, $41\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); IV-Leg-5, $44\mu\text{m}$ ($39\mu\text{m}$ - $41\mu\text{m}$); IV-Leg-6, $40\mu\text{m}$ ($34\mu\text{m}$ - $39\mu\text{m}$); greatest height of IV-Leg-2, $41\mu\text{m}$ ($42\mu\text{m}$); greatest height of IV-Leg-4, $69\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); figure 272 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsal shield as described for male; dorsal shield $281\mu\text{m}$ in length, $207\mu\text{m}$ in width; figure 565 shows the ornamentation of the dorsal shield; ventral shield $362\mu\text{m}$ in length, $233\mu\text{m}$ in width; anterior portion of ventral shield similar to male but projections associated with insertions of fourth legs are smaller and there is no development of a cauda (fig. 269); ridges posterior to insertions of fourth legs curving medially; gonopore terminal; a few acetabula present on each side; dorsal lengths of the palpal segments: P-I, $14\mu\text{m}$; P-II, $35\mu\text{m}$; P-III, $19\mu\text{m}$; P-IV, $35\mu\text{m}$; P-V, $18\mu\text{m}$; figure 270 shows the proportions and chaetotaxy of the palp; capitulum $69\mu\text{m}$ in length; chelicera $86\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $34\mu\text{m}$; I-Leg-5, $37\mu\text{m}$; I-Leg-6, $38\mu\text{m}$; greatest height of I-Leg-5, $31\mu\text{m}$; figure 274 shows these segments; dorsal lengths of the segments of the fourth leg: IV-Leg-2, $52\mu\text{m}$; IV-Leg-3, $29\mu\text{m}$; IV-Leg-4, $34\mu\text{m}$; IV-Leg-5, $31\mu\text{m}$; IV-Leg-6, $38\mu\text{m}$; greatest height of IV-Leg-2, $43\mu\text{m}$; greatest height of IV-Leg-4, $41\mu\text{m}$; structure of fourth leg is

somewhat similar to that shown for the male but ventral bulge on IV-Leg-4 is not as pronounced.

Holotype: Adult ♂, from Adamson Creek on Rt 6, between Lake Ianthe and Wanganui, South Island, Nov. 9, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: SOUTH ISLAND: 1 ♂, Whale Creek on Rt 6, west of Murchison, Nov. 7, 1982; 1 ♂, from Cole Creek on Rt 6, between Lake Moeraki and Haast, Nov. 10, 1982.

Discussion: Males of the present species may be easily separated from the other known species of the genus by its possession of a cauda and IV-Leg-4 is greatly expanded ventrally (fig. 272). Females also show this ventral expansion of IV-Leg-4 which, although not as great as in the male, is much greater than in females of the other species. The ornamentation of the dorsal sclerites is the least complex of the genus (fig. 565) and is also diagnostic.

Genus ABELATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets bearing one pair of glandularia; a pair of small glandularia sclerites located between medial corners of anterolateral and posterolateral platelets and lateral edge of posteromedial plate; posteromedial plate with two pairs of glandularia; dorsal sclerites reticulate (fig. 566); anterodorsal portion of ventral shield produced into a somewhat pointed hood which extends beyond tips of coxae; coxal slots well developed; projections associated with insertions of fourth legs very large and somewhat pointed (figs. 276, 281); a pair of glands immediately posteromedial to insertions of fourth legs; no pronounced sexual dimorphism of the legs; leg segments laterally compressed and high dorsoventrally (although the height of the anterior legs not as high as in members of the preceding two genera); IV-Leg-2 is largest segment of the fourth leg; IV-Leg-3 short, partially covered by IV-Leg-2 and its ventral side reduced to a median angle bearing two setae (fig. 277); capitulum much longer than high, without an anchoral process and attached to a tube of soft integument to form somewhat protrusible mouthparts (fig. 282); P-IV not broadened as in the previous two genera.

Type Species: *Abelaturus cornophorus*, new species.

46. Abelaturus cornophorus, new species

(Figs. 276-278, 280-282, 285, 566)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield 350 μm (338 μm -374 μm) in length, 273 μm (265 μm -297 μm) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; one pair of glandularia on "free" sclerites; posteromedial plate with two pairs of glandularia; ornamentation of dorsal sclerites consisting of a reticulate pattern as shown for the female (fig. 566); anteromedial portion of ventral shield forming a somewhat pointed dorsal hood which extends far beyond the tips of the first coxae; ventral shield 486 μm (460 μm -502 μm) in length, 312 μm (304 μm -334 μm) in width; tips of first three pairs of coxae somewhat pointed; capitular bay relatively shallow; intercoxal slots well developed; projections associated with insertions of fourth legs extremely large, projecting posterolaterally to edges of body (fig. 281); a pair of glandularia located somewhat medial to these projections; genital field region relatively simple, consisting of a small, oval gono-

pore flanked by three setae, which is located well anterior to the posterior end; a few genital acetabula present on each side; anterolateral portion of ventral shield with horn-like projections and posterolateral edges of ventral shield with small, posteriorly-directed projections (these may be more dorsally placed on the upper rim of ventral shield and not apparent in ventral view; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$ ($17\mu\text{m}$ - $19\mu\text{m}$); P-II, $32\mu\text{m}$ ($30\mu\text{m}$ - $31\mu\text{m}$); P-III, $20\mu\text{m}$ ($18\mu\text{m}$ - $19\mu\text{m}$); P-IV, $51\mu\text{m}$ ($48\mu\text{m}$ - $52\mu\text{m}$); P-V, $22\mu\text{m}$ ($21\mu\text{m}$ - $22\mu\text{m}$); the morphology of palp as illustrated for the female; capitulum $121\mu\text{m}$ ($117\mu\text{m}$ - $125\mu\text{m}$) in length; capitulum much longer than high with palp inserted well proximal to tip; capitulum attached to soft integument to form somewhat protrusible mouthparts; morphology of capitulum as shown for the female; chelicera $121\mu\text{m}$ ($114\mu\text{m}$ - $124\mu\text{m}$) in length; leg segments of first three pairs of legs tending to be longer and less proportionally high than in members of the genera *Palnaturus* and *Taintaturus*; dorsal lengths of the distal segments of the first leg: I-Leg-4, $38\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); I-Leg-5, $41\mu\text{m}$ ($39\mu\text{m}$ - $43\mu\text{m}$); I-Leg-6, $58\mu\text{m}$ ($57\mu\text{m}$ - $60\mu\text{m}$); greatest height of I-Leg-5, $24\mu\text{m}$ ($24\mu\text{m}$ - $27\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-2, $69\mu\text{m}$ ($67\mu\text{m}$ - $69\mu\text{m}$); IV-Leg-3, $24\mu\text{m}$ ($23\mu\text{m}$ - $24\mu\text{m}$); IV-Leg-4, $28\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); IV-Leg-5, $34\mu\text{m}$ ($32\mu\text{m}$ - $33\mu\text{m}$); IV-Leg-6, $45\mu\text{m}$ ($46\mu\text{m}$ - $49\mu\text{m}$); greatest height of IV-Leg-2, $31\mu\text{m}$ ($28\mu\text{m}$ - $31\mu\text{m}$); length of IV-Leg-1 not given because proximal portion is always broken off, but its distal portion proportionally much longer than in the preceding two genera.

Female: Dorsum as described for male; dorsal shield $380\mu\text{m}$ ($304\mu\text{m}$ - $365\mu\text{m}$) in length, $319\mu\text{m}$ ($266\mu\text{m}$ - $289\mu\text{m}$) in width; figure 566 shows the ornamentation of the dorsum; ventral shield $547\mu\text{m}$ ($425\mu\text{m}$ - $502\mu\text{m}$) in length, $349\mu\text{m}$ ($304\mu\text{m}$ - $334\mu\text{m}$) in width; except for genital field region, ventral shield as described for male; gonopore terminal and comparatively small and narrow (fig. 276); a few genital acetabula on each side; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($19\mu\text{m}$ - $20\mu\text{m}$); P-II, $33\mu\text{m}$ ($31\mu\text{m}$ - $33\mu\text{m}$); P-III, $19\mu\text{m}$ ($19\mu\text{m}$ - $21\mu\text{m}$); P-IV, $53\mu\text{m}$ ($48\mu\text{m}$ - $53\mu\text{m}$); P-V, $23\mu\text{m}$ ($21\mu\text{m}$ - $23\mu\text{m}$); figure 280 illustrates the proportions and chaetotaxy of the palp; capitulum $124\mu\text{m}$ ($93\mu\text{m}$ - $114\mu\text{m}$) in length and as described for male; chelicera $127\mu\text{m}$ ($97\mu\text{m}$ - $121\mu\text{m}$) in length; figure 282 shows a lateral view of the capitulum; dorsal lengths of the distal segments of the first leg: I-Leg-4, $41\mu\text{m}$ ($38\mu\text{m}$ - $40\mu\text{m}$); I-Leg-5, $46\mu\text{m}$ ($43\mu\text{m}$ - $45\mu\text{m}$); I-Leg-6, $62\mu\text{m}$ ($62\mu\text{m}$ - $63\mu\text{m}$); greatest height of I-Leg-5, $25\mu\text{m}$; figure 285 shows these segments; dorsal lengths of the segments of the fourth leg: IV-Leg-2, $79\mu\text{m}$ ($62\mu\text{m}$ - $76\mu\text{m}$); IV-Leg-3, $25\mu\text{m}$ ($21\mu\text{m}$ - $26\mu\text{m}$); IV-Leg-4, $31\mu\text{m}$ ($28\mu\text{m}$ - $31\mu\text{m}$); IV-Leg-5, $33\mu\text{m}$ ($28\mu\text{m}$ - $31\mu\text{m}$); IV-Leg-6, $48\mu\text{m}$ ($45\mu\text{m}$ - $48\mu\text{m}$); figure 277 illustrates the fourth leg.

Holotype: Adult ♂, tributary of the Wakamarina River, 7 km southeast of Canvastown (off Rt 6), South Island, Nov. 5, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 2 ♀, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglan (Coromandel Peninsula), North Island, Oct. 27, 1982; 4 ♂, from the Whangamoia River on Rt 6, approx. 5 km northeast of Whangamoia Saddle, South Island, Nov. 23, 1982.

Discussion: This is presently the only known member of its genus, and the characters given in the generic key are diagnostic.

Genus OMEGATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets bearing one pair of glandularia; a pair of small glandularia sclerites located

between medial corners of anterolateral and posterolateral platelets and the lateral edges of the posteromedial plate; posteromedial plate bearing two pairs of glandularia; dorsal sclerites with small reticulations (fig. 567); anterodorsal portion of ventral shield with a very broad hood which is indented medially (much as shown in figure 350); coxal slots well developed; projections associated with insertions of fourth legs of moderate size and truncate; a pair of glands located somewhat posteromedial to insertions of the fourth legs; no sexual dimorphism of the legs; leg segments, with the exception of IV-Leg-2, not laterally compressed, and even this segment is only slightly compressed; IV-Leg-3 short, with its ventral side becoming reduced to a median angle and bearing two setae (fig. 287); IV-Leg-2 only slightly covering IV-Leg-3; capitulum long, with an anchoral process and not protrusible; palpal segments elongated, P-II with a few small ventral integumental projections (fig. 283).

Type Species: *Omegaturus longipalpis*, new species.

Discussion: If one disregards the elongated capitulum and palpal segments which are without doubt derived conditions, this genus exhibits character states which seem to be at the beginning of transformation series in which the more derived conditions are found in the preceding three genera. These characteristics include greater dorsoventral expansion and lateral compression of the leg segments and greater development of an anterodorsal hood in the other three genera. *Omegaturus* shares a number of similarities with the genus *Piotaturus*, which is described later in this paper. See remarks under the latter genus.

47. *Omegaturus longipalpis*, new species

(Figs. 279, 283, 284, 286, 287, 290, 567)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $456\mu\text{m}$ ($426\mu\text{m}$ - $430\mu\text{m}$) in length, $410\mu\text{m}$ ($365\mu\text{m}$ - $395\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; one pair of glandularia on small free-lying sclerites; posteromedial plate with two pairs of glandularia; with a slight development of ridges on the dorsum; ornamentation of dorsum as shown for the female (fig. 567); anteromedial portion of ventral shield with a broad, medially indented hood similar to that shown in figure 350 but is even larger; ventral shield $638\mu\text{m}$ ($600\mu\text{m}$ - $610\mu\text{m}$) in length, $425\mu\text{m}$ ($395\mu\text{m}$ - $410\mu\text{m}$) in width; well developed coxal slots present; projections associated with insertions of fourth legs truncate and expanded at ends, with the lateral margins extending anteromedially; a pair of glands located slightly posteromedial to these projections; genital field area slightly projecting; gonopore small and somewhat subterminal; a few genital acetabula on each side; figure 286 shows the structure of the genital field; dorsal lengths of the palpal segments: P-I, $34\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); P-II, $100\mu\text{m}$ ($93\mu\text{m}$ - $98\mu\text{m}$); P-III, $97\mu\text{m}$ ($93\mu\text{m}$ - $95\mu\text{m}$); P-IV, $145\mu\text{m}$ ($147\mu\text{m}$ - $149\mu\text{m}$); P-V, $27\mu\text{m}$ ($24\mu\text{m}$ - $27\mu\text{m}$); ventral side of P-II with a few small cuticular spines; palpal segments greatly elongated as illustrated for the female; capitulum $131\mu\text{m}$ ($121\mu\text{m}$ - $128\mu\text{m}$) in length; chelicera $104\mu\text{m}$ ($104\mu\text{m}$ - $117\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $69\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); I-Leg-5, $79\mu\text{m}$ ($76\mu\text{m}$ - $78\mu\text{m}$); I-Leg-6, $79\mu\text{m}$ ($76\mu\text{m}$ - $79\mu\text{m}$); greatest height of I-Leg-5, $26\mu\text{m}$; structure of these segments as shown for female; dorsal lengths of the segments of the fourth leg: IV-Leg-2, $91\mu\text{m}$ ($87\mu\text{m}$ - $89\mu\text{m}$); IV-Leg-3, $32\mu\text{m}$ ($31\mu\text{m}$ - $32\mu\text{m}$); IV-Leg-4, $76\mu\text{m}$ ($73\mu\text{m}$ - $75\mu\text{m}$); IV-Leg-5, $76\mu\text{m}$ ($73\mu\text{m}$ - $75\mu\text{m}$); IV-Leg-6, $73\mu\text{m}$ ($69\mu\text{m}$ - $71\mu\text{m}$); greatest height of IV-Leg-2, $38\mu\text{m}$ ($35\mu\text{m}$ - $37\mu\text{m}$); figure 287 shows the propor-

tions and chaetotaxy of the fourth leg.

Female: Dorsum as described for the male; dorsal shield $410\mu\text{m}$ ($418\mu\text{m}$ - $456\mu\text{m}$) in length, $365\mu\text{m}$ ($368\mu\text{m}$ - $395\mu\text{m}$) in width; ventral shield $593\mu\text{m}$ ($593\mu\text{m}$ - $654\mu\text{m}$) in length, $395\mu\text{m}$ ($395\mu\text{m}$ - $426\mu\text{m}$) in width; except for genital field region, ventral shield as described for male; gonopore terminal; a few genital acetabula on each side (fig. 290); dorsal lengths of the palpal segments: P-I, $33\mu\text{m}$ ($31\mu\text{m}$ - $35\mu\text{m}$); P-II, $93\mu\text{m}$ ($95\mu\text{m}$ - $100\mu\text{m}$); P-III, $87\mu\text{m}$ ($89\mu\text{m}$ - $97\mu\text{m}$); P-IV, $143\mu\text{m}$ ($139\mu\text{m}$ - $149\mu\text{m}$); P-V, $27\mu\text{m}$ ($27\mu\text{m}$ - $28\mu\text{m}$); capitulum $130\mu\text{m}$ ($128\mu\text{m}$ - $135\mu\text{m}$) in length; chelicera $117\mu\text{m}$ ($121\mu\text{m}$ - $124\mu\text{m}$) in length; figure 283 illustrates the capitulum and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $59\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); I-Leg-5, $73\mu\text{m}$ ($75\mu\text{m}$ - $78\mu\text{m}$); I-Leg-6, $72\mu\text{m}$ ($73\mu\text{m}$ - $76\mu\text{m}$); greatest height of I-Leg-5, $25\mu\text{m}$ ($24\mu\text{m}$ - $25\mu\text{m}$); figure 279 shows these segments; dorsal lengths of the segments of the fourth leg: IV-Leg-2, $80\mu\text{m}$ ($81\mu\text{m}$ - $83\mu\text{m}$); IV-Leg-3, $31\mu\text{m}$ ($29\mu\text{m}$ - $35\mu\text{m}$); IV-Leg-4, $69\mu\text{m}$ ($69\mu\text{m}$ - $77\mu\text{m}$); IV-Leg-5, $72\mu\text{m}$ ($66\mu\text{m}$ - $74\mu\text{m}$); IV-Leg-6, $69\mu\text{m}$ ($69\mu\text{m}$ - $73\mu\text{m}$); greatest height of IV-Leg-2, $34\mu\text{m}$ ($36\mu\text{m}$ - $37\mu\text{m}$); fourth leg as shown for male.

Holotype: Adult ♂, from a stream at Sandy's Bridge, on Rt 2 in the "Gorge" south of Opotiki, North Island, Oct. 29, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 1 ♂, 1 ♀, same area as holotype on June 3, 1981; 1 ♂, from a stream at Opato Bridge, 67 km southeast of Opotiki, June 3, 1981; 1 ♂, 1 ♀, same data as holotype; SOUTH ISLAND: 2 ♀, from Graham Stream on Rt 6, at picnic grounds, 8 km northeast of Whangamoa Saddle, Nov. 23, 1982; 2 ♀, Whangamoa River on Rt 6, approx. 5 km northeast of Whangamoa Saddle, Nov. 23, 1982.

Genus TRYSSATUOPSIS Cook

Tryssatuopsis Cook, 1974. Mem. Amer. Ent. Inst., 21: 355.

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets bearing one pair of glandularia; posteromedial plate with three pairs of glandularia; projections associated with insertions of fourth legs appearing more or less pointed in ventral view, with a few to many setae along lateral margins of these projection; IV-Leg-1 very long and bearing numerous setae; IV-Leg-2 with a ventral or distoventral projection; males with a distinct cauda and the fourth leg exhibiting a pronounced sexual dimorphism; P-IV of relatively uniform height along entire length and with a small, thickened terminal seta on medial side (fig. 288).

Type Species: *Tryssatuopsis novus* (Hopkins).

Discussion: Cook (1974) described *Tryssatuopsis* as a subgenus of *Tryssaturus* but it certainly deserves full generic ranking.

KEY TO THE NEW ZEALAND SPECIES OF TRYSSATUOPSIS

1. Dorsal shield relatively wide and with closely set papillae (figs. 568, 570); males with the following set of characters: excretory pore placed on dorsal surface of cauda (figs. 289, 304); IV-Leg-4 without pectinate setae (figs. 294, 305); distal projection on IV-Leg-2 extending definitely distoventrally 2
- Dorsal shield proportionally narrower and with the papillae rela-

tively widely separated and interconnected producing a reticulate condition (figs. 569, 571); males with the following set of characters: excretory pore on dorsal rim of ventral shield near dorsal furrow (figs. 293, 302); IV-Leg-4 with one or two pectinate setae (figs. 299, 300); projection on IV-Leg-2 extending more or less ventrally 3

2. Some of the papillae of the dorsal shield much larger than the rest (fig. 570); male cauda relatively narrow (fig. 304)

Tryssaturopsis parvicaudatus, new species . (p. 66)

Papillae of dorsal shield of relatively uniform size (fig. 568); male cauda wide and tripartate (fig. 289)

Tryssaturopsis asopos, new species (p. 65)

3. Projection on male IV-Leg-2 extending directly ventrally with the dimensions in this direction greater than length of segment; swimming hairs absent from flattened surface of male IV-Leg-4 (fig. 300); male cauda somewhat pointed laterally (fig. 293)

Tryssaturopsis novus (Hopkins) (p. 67)

Projection on male IV-Leg-2 extending slightly distally as well as ventrally, with dimensions in this direction less than length of the segment; swimming hairs present on flattened surface of male IV-Leg-4 (fig. 299); male cauda more rounded laterally (fig. 302)

Tryssaturopsis solivagus, new species .. (p. 69)

48. Tryssaturopsis asopos, new species

(Figs. 288, 289, 291, 292, 294, 296, 568)

Male: Both eye and integumental pigment developed; dorsal shield $395\mu\text{m}$ ($342\mu\text{m}$ - $380\mu\text{m}$) in length, $380\mu\text{m}$ ($327\mu\text{m}$ - $365\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; posteromedial plate with three pairs of glandularia; dorsal shield with ridges which are similar, but somewhat more pronounced, than shown for female; dorsal sclerites with small papillae of a relatively uniform size (fig. 568); ventral shield $562\mu\text{m}$ ($479\mu\text{m}$ - $562\mu\text{m}$) in length, $399\mu\text{m}$ ($361\mu\text{m}$ - $380\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae lateral to anterior ends of the insertions of fourth legs; projections associated with insertions of fourth legs bluntly pointed and with numerous setae on lateral margins; genital field lying on a well developed cauda whose morphology is better illustrated (fig. 292) than described; cauda $304\mu\text{m}$ ($262\mu\text{m}$ - $293\mu\text{m}$) in width; a pair of ridges extending anteromedially from corners of body proper; gonopore small and nearly terminal; many genital acetabula present, these in three groups (fig. 289) and mostly confined to the dorsal surface; dorsal lengths of the palpal segments: P-I, $31\mu\text{m}$ ($29\mu\text{m}$ - $30\mu\text{m}$); P-II, $59\mu\text{m}$ ($59\mu\text{m}$ - $62\mu\text{m}$); P-III, $29\mu\text{m}$ ($27\mu\text{m}$ - $30\mu\text{m}$); P-IV, $96\mu\text{m}$ ($97\mu\text{m}$); P-V, $28\mu\text{m}$ ($29\mu\text{m}$ - $30\mu\text{m}$); structure of palp as shown for the female; capitulum $107\mu\text{m}$ ($97\mu\text{m}$ - $107\mu\text{m}$) in length; chelicera $145\mu\text{m}$ ($131\mu\text{m}$ - $140\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $83\mu\text{m}$ ($84\mu\text{m}$); I-Leg-5, $93\mu\text{m}$ ($92\mu\text{m}$); I-Leg-6, $92\mu\text{m}$ ($90\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-1, $222\mu\text{m}$ ($196\mu\text{m}$ - $241\mu\text{m}$); IV-Leg-2, $96\mu\text{m}$ ($81\mu\text{m}$ - $89\mu\text{m}$); IV-Leg-3, $96\mu\text{m}$ ($93\mu\text{m}$ - $97\mu\text{m}$); IV-Leg-4, $133\mu\text{m}$ ($129\mu\text{m}$ - $141\mu\text{m}$); IV-Leg-5, $118\mu\text{m}$ ($125\mu\text{m}$ - $131\mu\text{m}$); IV-Leg-6, $137\mu\text{m}$ ($118\mu\text{m}$ - $133\mu\text{m}$); projection

on IV-Leg-2 extending distoventrally and truncate; IV-Leg-4 only slightly expanded; figure 294 shows the structure of the fourth leg.

Female: Ornamentation and arrangement of glandularia as described for the male; dorsal shield $425\mu\text{m}$ ($364\mu\text{m}$ - $425\mu\text{m}$) in length, $380\mu\text{m}$ ($334\mu\text{m}$ - $388\mu\text{m}$) in width; ventral shield $516\mu\text{m}$ ($434\mu\text{m}$ - $547\mu\text{m}$) in length, $395\mu\text{m}$ ($342\mu\text{m}$ - $399\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae located slightly anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs pointed when viewed ventrally, and with several setae on lateral margins; genital field region somewhat projecting; genital acetabula numerous; figure 296 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, $32\mu\text{m}$ ($29\mu\text{m}$ - $33\mu\text{m}$); P-II, $58\mu\text{m}$ ($52\mu\text{m}$ - $59\mu\text{m}$); P-III, $28\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); P-IV, $76\mu\text{m}$ ($66\mu\text{m}$ - $77\mu\text{m}$); P-V, $29\mu\text{m}$ ($28\mu\text{m}$ - $31\mu\text{m}$); figure 288 shows the proportions and chaetotaxy of the palp; capitulum $103\mu\text{m}$ ($103\mu\text{m}$ - $110\mu\text{m}$) in length; chelicera $138\mu\text{m}$ ($138\mu\text{m}$ - $159\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $69\mu\text{m}$ ($66\mu\text{m}$ - $70\mu\text{m}$); I-Leg-5, $77\mu\text{m}$ ($73\mu\text{m}$ - $86\mu\text{m}$); I-Leg-6, $76\mu\text{m}$ ($76\mu\text{m}$ - $83\mu\text{m}$); figure 291 shows the structure of these segments.

Holotype: Adult ♂, from Waikohatu Stream on Rt 12, in the Kauri Forest, northern North Island, May 29, 1981.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 3 ♂, 4 ♀, same data as holotype; 1 ♂, from Te Whaiau Stream at junction of Rt 47 and Rotaaria Rd, June 5, 1981; 1 ♀, Waikohatu Stream on Rt 12 (in Waipoua State Forest), Oct. 24, 1982; 1 ♀, Torere River at Torere, on Rt 35 north of Opotiki, Oct. 28, 1982; 1 ♀, 4 ♀, from a stream 1 km north of Tohere (east of Opotiki) on Rt 35, Oct. 29, 1982; 2 ♂, 14 ♀, from the Kotare "River", on Rt. 30, Oct. 31, 1982.

Discussion: The structure of the cauda (fig. 289) and the only slight expansion of IV-Leg-4 are diagnostic for the male. A dorsal shield with pronounced ridges, papillae of the dorsum all the same size and position of the glands of the fourth coxae somewhat anteromedial to insertions of fourth legs are diagnostic for the female.

49. Tryssaturopsis parvicaudatus, new species

(Figs. 301, 303-305, 307, 570)

Male: Both eye and integumental pigment developed; dorsal shield $395\mu\text{m}$ ($350\mu\text{m}$ - $374\mu\text{m}$) in length, $358\mu\text{m}$ ($319\mu\text{m}$ - $350\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets bearing a pair of glandularia; posteromedial plate with three pairs of glandularia; dorsal shield with both large and small papillae as in the female (fig. 570); ventral shield $547\mu\text{m}$ ($502\mu\text{m}$ - $520\mu\text{m}$) in length, $380\mu\text{m}$ ($334\mu\text{m}$ - $365\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae located somewhat anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs somewhat pointed and with several setae on lateral margins; genital field on a proportionally narrow but distinct cauda whose morphology is better illustrated (fig. 307) than described; cauda $167\mu\text{m}$ ($152\mu\text{m}$ - $167\mu\text{m}$) in width; well developed ridges extending anteromedially from posterior corners of body proper; gonopore small, simple and almost terminal; many genital acetabula present, most of which are confined to the ventral surface; dorsal lengths of the palpal segments: P-I, $29\mu\text{m}$ ($28\mu\text{m}$ - $29\mu\text{m}$); P-II, $52\mu\text{m}$ ($48\mu\text{m}$ - $52\mu\text{m}$); P-III, $26\mu\text{m}$ ($24\mu\text{m}$ - $25\mu\text{m}$); P-IV, $69\mu\text{m}$ ($64\mu\text{m}$ - $69\mu\text{m}$); P-V, $27\mu\text{m}$ ($25\mu\text{m}$ - $28\mu\text{m}$); structure of palp as shown for a related spe-

cies (fig. 288); capitulum $86\mu\text{m}$ ($73\mu\text{m}$ - $80\mu\text{m}$) in length; chelicera $114\mu\text{m}$ ($97\mu\text{m}$ - $111\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $72\mu\text{m}$ ($66\mu\text{m}$ - $69\mu\text{m}$); I-Leg-5, $83\mu\text{m}$ ($76\mu\text{m}$ - $83\mu\text{m}$); I-Leg-6, $79\mu\text{m}$ ($72\mu\text{m}$ - $79\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-1, $207\mu\text{m}$ ($200\mu\text{m}$ - $207\mu\text{m}$); IV-Leg-2, $89\mu\text{m}$ ($81\mu\text{m}$ - $91\mu\text{m}$); IV-Leg-3, $59\mu\text{m}$ ($59\mu\text{m}$ - $63\mu\text{m}$); IV-Leg-4, $137\mu\text{m}$ ($126\mu\text{m}$ - $130\mu\text{m}$); IV-Leg-5, $111\mu\text{m}$ ($104\mu\text{m}$ - $108\mu\text{m}$); IV-Leg-6, $111\mu\text{m}$ ($109\mu\text{m}$ - $115\mu\text{m}$); IV-Leg-2 with a distoventral projection which is somewhat truncate; IV-Leg-4 greatly expanded; figure 305 shows the proportions and chaetotaxy of the fourth leg.

Female: Ornamentation and arrangement of the glandularia of the dorsum as described for the male; dorsal shield $388\mu\text{m}$ ($380\mu\text{m}$ - $406\mu\text{m}$) in length, $349\mu\text{m}$ ($342\mu\text{m}$ - $364\mu\text{m}$) in width; figure 570 shows the enlarged papillae on the dorsal sclerites which are characteristic of this species; ventral shield $502\mu\text{m}$ ($486\mu\text{m}$ - $502\mu\text{m}$) in length, $364\mu\text{m}$ ($356\mu\text{m}$ - $380\mu\text{m}$) in width; anterior coxae projecting; glands of fourth coxae located anterior but slightly medial to insertions of the fourth legs; projections associated with insertions of fourth legs appearing to be pointed in ventral view and with several setae on lateral edges; genital field region distinctly set off from remainder of ventral shield; genital acetabula numerous; figure 301 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, $29\mu\text{m}$ ($29\mu\text{m}$ - $32\mu\text{m}$); P-II, $52\mu\text{m}$ ($48\mu\text{m}$ - $55\mu\text{m}$); P-III, $27\mu\text{m}$ ($24\mu\text{m}$ - $28\mu\text{m}$); P-IV, $67\mu\text{m}$ ($65\mu\text{m}$ - $72\mu\text{m}$); P-V, $28\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); capitulum $90\mu\text{m}$ ($87\mu\text{m}$ - $90\mu\text{m}$) in length; chelicera $117\mu\text{m}$ ($117\mu\text{m}$ - $130\mu\text{m}$) in length; figure 303 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $60\mu\text{m}$ ($59\mu\text{m}$ - $64\mu\text{m}$); I-Leg-5, $66\mu\text{m}$ ($66\mu\text{m}$ - $71\mu\text{m}$); I-Leg-6, $69\mu\text{m}$ ($66\mu\text{m}$ - $69\mu\text{m}$).

Holotype: Adult ♂, from Waikohatu Stream on Rt 12 (in the Kauri Forest), northern North Island, May 29, 1981.

Allotype: Adult ♀, same data as holotype.

Paratypes: 1 ♂, 8 ♀, same data as holotype; 4 ♂, 1 ♀, from Waikohatu Stream on Rt 12 (in Waipoua State Forest), northern North Island, Oct. 24, 1982.

Discussion: The narrow cauda is diagnostic for the male. Females may be distinguished from other members of the genus by the presence of conspicuous enlarged papillae on the dorsal sclerites (fig. 570).

50. Tryssaturopsis novus (Hopkins)

(Figs. 293, 295, 297, 300, 569)

Tryssaturus novus Hopkins, 1967. Trans. Royal Soc. New Zealand, 10: 41.

Tryssaturus (Tryssaturopsis) novus Cook, 1974. Mem. Amer. Ent. Inst., 21: 355.

Male: Both eye and integumental pigment well developed; dorsal shield $380\mu\text{m}$ ($372\mu\text{m}$ - $410\mu\text{m}$) in length, $304\mu\text{m}$ ($274\mu\text{m}$ - $319\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; posteromedial plate with three pairs of glandularia; dorsal shield with a reticulate ornamentation as shown for the female (fig. 569); ventral shield $525\mu\text{m}$ ($502\mu\text{m}$ - $532\mu\text{m}$) in length, $319\mu\text{m}$ ($304\mu\text{m}$ - $349\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae lying directly anterior to insertions of the fourth legs; projections associated with insertions of fourth legs pointed when viewed laterally and with a few setae on lateral margins; genital field lying on a well developed cauda whose morphology is better illustrated (fig. 295) than des-

cribed; cauda $288\mu\text{m}$ ($266\mu\text{m}$ - $290\mu\text{m}$) in width; U-shaped ridges, partially enclosing a pair of glandularia, extending anteromedially at base of cauda and beginning well medial to corners of body proper; gonopore small, simple and almost terminal; many genital acetabula present, most of which are confined to the dorsal surface (fig. 293); dorsal lengths of the palpal segments: P-I, $31\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); P-II, $64\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); P-III, $31\mu\text{m}$ ($28\mu\text{m}$ - $31\mu\text{m}$); P-IV, $80\mu\text{m}$ ($76\mu\text{m}$ - $80\mu\text{m}$); P-V, $31\mu\text{m}$ ($30\mu\text{m}$ - $31\mu\text{m}$); structure of palp as in the related species (fig. 288); capitulum $93\mu\text{m}$ ($89\mu\text{m}$ - $90\mu\text{m}$) in length; chelicera $145\mu\text{m}$ ($142\mu\text{m}$ - $146\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $83\mu\text{m}$ ($76\mu\text{m}$ - $79\mu\text{m}$); I-Leg-5, $86\mu\text{m}$ ($86\mu\text{m}$ - $87\mu\text{m}$); I-Leg-6, $83\mu\text{m}$ ($84\mu\text{m}$ - $87\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-1, $177\mu\text{m}$ ($163\mu\text{m}$ - $170\mu\text{m}$); IV-Leg-2, $88\mu\text{m}$ ($74\mu\text{m}$ - $81\mu\text{m}$); IV-Leg-3, $96\mu\text{m}$ ($81\mu\text{m}$ - $94\mu\text{m}$); IV-Leg-4, $148\mu\text{m}$ ($133\mu\text{m}$ - $162\mu\text{m}$); IV-Leg-5, $133\mu\text{m}$ ($133\mu\text{m}$ - $141\mu\text{m}$); IV-Leg-6, $125\mu\text{m}$ ($123\mu\text{m}$ - $126\mu\text{m}$); IV-Leg-2 with a large projection which extends directly ventrally; IV-Leg-4 greatly expanded; figure 300 shows the proportions and chaetotaxy of the fourth leg.

Female: Ornamentation and arrangement of the glandularia of dorsum as described for male; dorsal shield $380\mu\text{m}$ ($372\mu\text{m}$ - $395\mu\text{m}$) in length, $297\mu\text{m}$ ($289\mu\text{m}$ - $319\mu\text{m}$) in width; figure 569 is a photograph of the dorsum; ventral shield $456\mu\text{m}$ ($440\mu\text{m}$ - $456\mu\text{m}$) in length, $304\mu\text{m}$ ($296\mu\text{m}$ - $319\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae located nearly directly anterior to the insertions of the fourth legs; projections associated with insertions of the fourth legs pointed when viewed ventrally and with two or three setae on lateral margins; genital field region not distinctly set off from body; genital acetabula numerous; figure 297 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, $30\mu\text{m}$ ($30\mu\text{m}$ - $31\mu\text{m}$); P-II, $65\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); P-III, $31\mu\text{m}$ ($30\mu\text{m}$ - $33\mu\text{m}$); P-IV, $76\mu\text{m}$ ($71\mu\text{m}$ - $80\mu\text{m}$); P-V, $31\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); structure of palp similar to that of the related species (fig. 288); capitulum $86\mu\text{m}$ ($87\mu\text{m}$ - $90\mu\text{m}$) in length; chelicera $152\mu\text{m}$ ($149\mu\text{m}$ - $152\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $72\mu\text{m}$ ($67\mu\text{m}$ - $76\mu\text{m}$); I-Leg-5, $76\mu\text{m}$ ($71\mu\text{m}$ - $81\mu\text{m}$); I-Leg-6, $74\mu\text{m}$ ($71\mu\text{m}$ - $83\mu\text{m}$).

Material Examined: NORTH ISLAND: 13 ♂, 14 ♀, Waikohatu Stream on Rt 12 (in Kauri Forest), May 29, 1981; 2 ♂, 3 ♀, from Te Whaiiau Stream at junction of Rt 47 and Rotoaria Rd, June 5, 1981; 10 ♂, 17 ♀, Orauhora Stream on Rt 30, between Barryville and Benneydale, June 6, 1981; 3 ♀, Waikohatu Stream on Rt 12 (in Waipoua State Forest), Oct. 24, 1982; 1 ♂, Mangamawhete Stream on Rt 3, between Inglewood and Stratford (Egmont area), Nov. 1, 1982; 18 ♂, 17 ♀, from a stream on Rt 6 just north of Makatote Viaduct, between Raetiki and National Park, Nov. 2, 1982; 4 ♂, 1 ♀, Makokomiko Stream on Rt 4 (1 km south of Erua), between Erua and National Park, Nov. 2, 1982; 4 ♂, 7 ♀, Otupoto Stream on Rt 32, west of Lake Taupo, Nov. 3, 1982.

Discussion: The structure of the cauda and fourth legs relate the present species to the following, *T. solivagus*, both differing from other known members of the genus in having a cauda nearly as wide as the body. Also, the ridges at the posterior end of the body proper are U-shaped and are placed well medial to lateral edges of body (figs. 295, 298). Females of the present species differ from other known females of the genus in not having the genital field distinctly set off from the rest of the body and in the reticulate ornamentation of the dorsal sclerites. The female of the following species, which is unknown, is expected to be very similar to that of the present female.

51. Tryssaturopsis solivagus, new species

(Figs. 298, 299, 302, 571)

Male: Both eye and integumental pigment well developed; dorsal shield 388 μm in length, 289 μm in width; anteromedial plate bearing the postocularia; the anterolateral platelets with one pair of glandularia and the posteromedial plate with three pairs of glandularia; figure 571 shows the ornamentation of the dorsal shield; ventral shield 540 μm in length, 319 μm in width; anterior coxae projecting; glands of the fourth coxae located directly anterior to insertions of the fourth legs; projections associated with insertions of fourth legs somewhat pointed and with several setae on lateral margins; genital field lying on a well developed cauda whose morphology is better illustrated (fig. 298) than described; cauda 270 μm in width; U-shaped ridges, partially surrounding a pair of glandularia, extending anteromedially from base of cauda and beginning well medial to posterior corners of body proper; gonopore small, simple and almost terminal; many genital acetabula present, most of which are confined to the dorsal surface (fig. 302); dorsal lengths of the palpal segments: P-I, 27 μm ; P-II, 48 μm ; P-III, 24 μm ; P-IV, 66 μm ; P-V, 25 μm ; palp similar to that of other members of the genus; capitulum 83 μm in length; chelicera 107 μm in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 76 μm ; I-Leg-5, 83 μm ; I-Leg-6, 86 μm ; dorsal lengths of the segments of the fourth leg: IV-Leg-1, 155 μm ; IV-Leg-2, 89 μm ; IV-Leg-3, 79 μm ; IV-Leg-4, 137 μm ; IV-Leg-5, 100 μm ; IV-Leg-6, 96 μm ; IV-Leg-2 with a somewhat pointed ventral projection; IV-Leg-4 expanded and bearing a dorsal row of setae (fig. 299).

Female: Unknown (but expected to be very similar to that of the preceding species).

Holotype: Adult σ , from Waikohatu Stream on Rt 12, in the Kauri Forest (Waipoua State Forest), North Island, May 29, 1981.

Discussion: This species is most closely related to *T. novus* but differs in having the projection on IV-Leg-2 directed somewhat more distoventrally and the dorsal side of IV-Leg-4 with a row of setae. The cauda is less distinctly set off from the body proper in the present species (compare figures 293, 302) and the ridges on the ventral shield are different (compare figures 295, 298).

Genus PILOSATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets with one pair of glandularia; a pair of glandularia sclerites (glandularia 2) between medial corners of anterolateral and posterolateral platelets and the lateral edges of the posteromedial plate; posteromedial plate bearing two pairs of glandularia; postocularia and all dorsal glandularia on well developed tubercles (fig. 308); integument with numerous, closely packed, fine pointed projections, giving it a velvety appearance (fig. 572); posterior margins of fourth coxae extending decidedly posteromedially (figs. 309, 313); glands of the fourth coxae greatly reduced in size and well removed from suture lines between third and fourth coxae; male without a distinct cauda, although genital field region is slightly set off from the body; male fourth leg exhibiting a slight sexual dimorphism (fig. 306); coxal slots not developed; legs not laterally compressed; P-II without ventral papillae; IV-Leg-1 relatively long.

Type Species: *Pilosaturus villosus* (Hopkins).

52. Pilosaturus villosus (Hopkins)

(Figs. 306-313, 572)

Tryssaturus villosus Hopkins, 1967. Trans. Royal Soc. New Zealand, 10: 38.

Male: Eye pigment developed; dorsal shield $433\mu\text{m}$ in length, $380\mu\text{m}$ in width; anteromedial plate bearing the postocularia on small humps; anterolateral platelets with a pair of glandularia; one pair of glandularia located on small sclerites lying free in the integument; two pairs of glandularia present on posteromedial plate; all dorsoglandularia on small humps (fig. 308); with numerous, small integumental projections giving the mite a velvety appearance; ventral shield $540\mu\text{m}$ in length, $410\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae very small and placed anterior to insertions of fourth legs; projections associated with insertions of fourth legs pointed and with several setae on lateral edges; genital field slightly set off from rest of body to form a very short cauda $193\mu\text{m}$ in width; a pair of enlarged glandularia tubercles extending somewhat posterior to the genital field; many pairs of acetabula present; gonopore small, simple and nearly terminal in position; third, and especially the fourth, coxae projecting posteromedially, with posterior suture lines of fourth coxae extending nearly to the genital field (fig. 313); dorsal lengths of the palpal segments: P-I, $41\mu\text{m}$; P-II, $69\mu\text{m}$; P-III, $31\mu\text{m}$; P-IV, $87\mu\text{m}$; P-V, $36\mu\text{m}$; structure of palp as shown for the female; capitulum $112\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $85\mu\text{m}$; I-Leg-5, $93\mu\text{m}$; I-Leg-6, $86\mu\text{m}$; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $145\mu\text{m}$; IV-Leg-2, $93\mu\text{m}$; IV-Leg-3, $90\mu\text{m}$; IV-Leg-4, $117\mu\text{m}$; IV-Leg-5, $121\mu\text{m}$; IV-Leg-6, $114\mu\text{m}$; fourth leg slightly modified, with IV-Leg-2 bearing a ventrally directed, thickened seta; IV-Leg-3 with three heavy setae and IV-Leg-5 somewhat swollen (fig. 306).

Female: Eye pigment developed; dorsal shield $479\mu\text{m}$ - $498\mu\text{m}$ in length, $412\mu\text{m}$ - $418\mu\text{m}$ in width; structure of dorsum as described for the male; figure 572 shows the ornamentation of the dorsal shield; ventral shield $540\mu\text{m}$ - $577\mu\text{m}$ in length, $434\mu\text{m}$ - $440\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae small and placed anterior to insertions of fourth legs; projections associated with insertions of fourth legs pointed in ventral view and with three long setae on lateral margins; genital field subterminal; gonopore much larger than in male; many genital acetabula present; third and fourth coxae extending posteromedially; posterior suture lines of fourth coxae ending near genital field; figure 309 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $41\mu\text{m}$ - $43\mu\text{m}$; P-II, $74\mu\text{m}$ - $76\mu\text{m}$; P-III, $34\mu\text{m}$ - $36\mu\text{m}$; P-IV, $93\mu\text{m}$ - $95\mu\text{m}$; P-V, $40\mu\text{m}$; figure 311 shows the proportions and chaetotaxy of the palp; capitulum $114\mu\text{m}$ - $118\mu\text{m}$ in length; chelicera $179\mu\text{m}$ - $183\mu\text{m}$ in length; figure 312 shows a lateral view of the capitulum and chelicera; dorsal lengths of the distal segments of the first leg: I-Leg-4, $71\mu\text{m}$ - $76\mu\text{m}$; I-Leg-5, $83\mu\text{m}$ - $86\mu\text{m}$; I-Leg-6, $83\mu\text{m}$; figure 310 shows the structure of these segments; fourth legs not exhibiting sexual dimorphism, i.e., no heavy setae on IV-Leg-2 and 3, and IV-Leg-5 not swollen.

Material Examined: The type locality of this species is a stream in the Tarrarua Mountains in southern North Island and the above description is based in part on material from this region sent to me by Dr. Ceri Hopkins. I took a female from Whale Creek on Rt 6, west of Murchison, South Island, Nov. 7, 1982.

Discussion: Although the pilose integument is unusual, it is also found in one of the species of *Piotaturus*. Most noticeable differences are the posteromedially directed third and fourth coxae (which extend nearly to the genital field) and the presence of enlarged tubercles bearing the dorsal glandularia. The sexual dimorphism of the male fourth leg, though slight, is distinctive and unlike that in any other genus of Notoaturinae.

Genus TRYSSATURUS Hopkins

Tryssaturus Hopkins, 1967. Trans. Royal Soc. New Zealand, 10: 36.

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets with one pair of glandularia; a pair of small glandularia sclerites (glandularia 2) between medial corners of anterolateral and posterolateral platelets and lateral edges of posteromedial plate; posteromedial plate with two pairs of glandularia; none of the glandularia on tubercles; dorsal sclerites with a reticulate pattern (fig. 573); coxae confined to anterior half of body; posterior suture lines of fourth coxae extending more or less at right angles to the long axis of the body (figs. 316, 318); glands of the fourth coxae of normal size and placed well posterior to suture lines between third and fourth coxae; coxal slots absent, legs not laterally compressed; P-II with a few very small ventral papillae; P-IV of nearly the same height along entire length and with a small but thickened terminal seta medially; IV-Leg-1 relatively long and bearing numerous setae; male without a distinct cauda; male fourth leg exhibiting a slight sexual dimorphism consisting of a patch of setae on IV-Leg-2 and a large extension of IV-Leg-3, bearing a peg-like seta (fig. 317); female has a distal projection on IV-Leg-2 but has only two or three setae in area where male has a patch of them; female also with a short distal extension of IV-Leg-3 bearing a short peg-like seta.

Type Species: *Tryssaturus spinipes* Hopkins.

Discussion: All other species previously assigned to *Tryssaturus* have been placed in other genera, leaving only one species.

53. Tryssaturus spinipes Hopkins

(Figs. 314-319, 573)

Tryssaturus spinipes Hopkins, 1967. Trans. Royal Soc. New Zealand, 10: 36.

Male: Eye and integumental pigmentation well developed; dorsal shield 373 μm -395 μm in length, 265 μm -293 μm in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; one pair of glandularia located on free sclerites; posteromedial plate with two pairs of glandularia; male dorsal shield with the same characteristic reticulate ornamentation shown for the female (fig. 573); ventral shield 441 μm -479 μm in length, 273 μm -304 μm in width; anterior coxae projecting; glands of the fourth coxae placed anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs appearing somewhat pointed in ventral view and with a few long setae on lateral edges; posterior margins of fourth coxae placed at right angles to long axis of body; fourth coxae located in anterior half of body and far removed from the genital field; genital field nearly terminal; gonopore small, oval and placed near posterior end of body; many genital acetabula present; figure 316 shows the ventral shield; dorsal lengths of the palpal segments: P-I, 24 μm -29 μm ;

P-II, 49 μ m-53 μ m; P-III, 22 μ m-24 μ m; P-IV, 62 μ m-69 μ m; P-V, 26 μ m-28 μ m; structure of palp as illustrated for female; capitulum 79 μ m-83 μ m in length; the chelicera 104 μ m-110 μ m in length; structure of capitulum and chelicera much as shown for the related genus (fig. 303); dorsal lengths of the distal segments of the first leg: I-Leg-4, 65 μ m-72 μ m; I-Leg-5, 69 μ m-76 μ m; I-Leg-6, 69 μ m-79 μ m; dorsal lengths of the segments of the fourth leg: IV-Leg-1, 162 μ m; IV-Leg-2 (to tip of distal projection) 110 μ m-118 μ m; IV-Leg-3 (to tip of distal projection) 128 μ m-131 μ m; IV-Leg-4, 76 μ m-79 μ m; IV-Leg-5, 72 μ m-79 μ m; IV-Leg-6, 72 μ m-79 μ m; IV-Leg-2 with a long distal projection and a patch of thickened setae medially; IV-Leg-3 with a well developed distal projection which bears a short, thickened seta; figure 317 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for the male (fig. 573); dorsal shield 350 μ m-410 μ m in length, 258 μ m-304 μ m in width; ventral shield 411 μ m-479 μ m in length, 274 μ m-304 μ m in width; anterior coxae projecting; glands of the fourth coxae are placed anteromedial to insertions of fourth legs; projections associated with the insertions of fourth legs appearing pointed in ventral view; posterior margins of fourth coxae directed slightly anteromedially; fourth coxae located in anterior half of body and far removed from genital field; genital field subterminal; gonopore much longer than wide; many genital acetabula present; figure 318 shows the ventral shield; dorsal lengths of the palpal segments: P-I, 25 μ m-28 μ m; P-II, 50 μ m-55 μ m; P-III, 26 μ m-28 μ m; P-IV, 60 μ m-69 μ m; P-V, 27 μ m-31 μ m; figure 319 shows the proportions and chaetotaxy of the palp; capitulum 69 μ m-79 μ m in length; chelicera 100 μ m-114 μ m in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62 μ m-64 μ m; I-Leg-5, 64 μ m-71 μ m; I-Leg-6, 67 μ m-76 μ m; figure 315 shows these segments.

Material Examined: NORTH ISLAND: 4 σ , 2 ϕ , from a stream on Rt 6, just north of Makatote Viaduct between Raetiki and National Park, Nov. 2, 1982; SOUTH ISLAND: 2 ϕ , Whangamoia River on Rt 6, 3 km northeast of Whangamoia Saddle, Nov. 6, 1982; 9 σ , 11 ϕ , Whale Creek on Rt 6, west of Murchison, Nov. 7, 1982; 1 ϕ , Irongate Stream on Rt 1, 24 km north of Kaikouri, Nov. 21, 1982; 1 σ , Wakapuaka River on Rt 6, on western edge of Hira State Forest, Nov. 23, 1982.

Discussion: The characters given in the generic key are sufficient to diagnose members of both sexes of the present species. The type locality of the species is a stream in the Tararua Mountains of southern North Island but Hopkins also collected it in the Egmont area.

Genus NEOTRYSSATURUS Cook

Neotryssaturus Cook, 1974. Mem. Amer. Ent. Inst., 21: 355.

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets with one pair of glandularia; a pair of glandularia on small sclerites (glandularia 2) located between medial corners of anterolateral and posterolateral platelets and lateral edges of posteromedial plate; posteromedial plate with two pairs of glandularia; glandularia not on large tubercles; dorsal sclerites with low papillae (figs. 574, 575); coxae confined to anterior half of body; posterior margins of fourth coxae extending more or less at right angles to long axis of body (figs. 320, 324); glands of the fourth coxae of normal size and placed well posterior to suture lines between third and fourth coxae; coxal slots absent, legs not laterally compressed; P-II without ventral papillae; P-IV of nearly uniform height along entire length and with a small but thickened terminal seta medially;

IV-Leg-1 tending to be somewhat lengthened but not to the degree found in the genus *Tryssaturus*; males with a distinct cauda which is very narrow at base and then widens abruptly at posterior end (figs. 320, 336); male fourth leg exhibiting slight (fig. 327) to pronounced (fig. 322) sexual dimorphism.

Type Species: *Neotryssaturus inusitatus* (Hopkins)

Discussion: The present genus exhibits a number of similarities with *Tryssaturus*. These include an almost identical morphology of the mouthparts and the coxal region. *Neotryssaturus* differs in its strong sexual dimorphism of the male body, a different dimorphism of the male fourth leg, and different ornamentation of the dorsal sclerites.

54. Neotryssaturus inusitatus (Hopkins)

(Figs. 320-325, 328, 329, 574)

Tryssaturus inusitatus Hopkins, 1967. Trans. Royal Soc. New Zealand, 10: 41.
Tryssaturus (*Neotryssaturus*) *inusitatus* Cook, 1974. Mem. Amer. Ent. Inst., 21: 355.

Male: Eye pigment well developed; dorsal shield $380\mu\text{m}$ - $394\mu\text{m}$ in length, $334\mu\text{m}$ - $357\mu\text{m}$ in width; anteromedial plate bearing the postocularia on small humps; one pair of glandularia present on anterolateral platelets; one pair of glandularia on small sclerites which lie free in the integument; two pairs of glandularia on posteromedial plate; dorsal glandularia lying on very small humps; sclerites of dorsum with numerous very small papillae and scattered larger papillae similar to those shown for the female (fig. 574); ventral shield $516\mu\text{m}$ - $532\mu\text{m}$ in length, $388\mu\text{m}$ - $395\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae lying anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs appearing pointed in ventral view and with a few long lateral setae; genital field located on a well developed cauda; cauda is widest ($197\mu\text{m}$ - $206\mu\text{m}$) near posterior end and narrowest at base; several pairs of acetabula located laterally on ventral side of cauda; gonopore nearly terminal and noticeably longer than wide; numerous setae present along lateral edges of cauda, these setae best seen in lateral view (fig. 325); posterior suture lines of fourth coxae placed at right angles to long axis of body; fourth coxae located in anterior half of body and far removed from genital field; figure 320 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $35\mu\text{m}$ - $36\mu\text{m}$; P-II, $69\mu\text{m}$ - $70\mu\text{m}$; P-III, $31\mu\text{m}$; P-IV, $93\mu\text{m}$ - $95\mu\text{m}$; P-V, $34\mu\text{m}$ - $35\mu\text{m}$; structure of palp as shown for female; capitulum $110\mu\text{m}$ in length; chelicera $148\mu\text{m}$ - $152\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $90\mu\text{m}$ - $97\mu\text{m}$; I-Leg-5, $103\mu\text{m}$ - $104\mu\text{m}$; I-Leg-6, $91\mu\text{m}$ - $93\mu\text{m}$; dorsal lengths of the distal segments of the fourth leg: IV-Leg-1, $156\mu\text{m}$; IV-Leg-2, $93\mu\text{m}$ - $97\mu\text{m}$; IV-Leg-3, $62\mu\text{m}$ - $72\mu\text{m}$; I-Leg-4, $176\mu\text{m}$ - $190\mu\text{m}$; I-Leg-5, $162\mu\text{m}$; I-Leg-6, $92\mu\text{m}$ - $96\mu\text{m}$; structure of fourth leg better illustrated (fig. 322) than described; figure 321 shows a slightly different view of IV-Leg-5 and 6.

Female: Dorsum as described for male (fig. 574); dorsal shield $380\mu\text{m}$ - $395\mu\text{m}$ in length, $334\mu\text{m}$ - $357\mu\text{m}$ in width; ventral shield $449\mu\text{m}$ - $494\mu\text{m}$ in length, $346\mu\text{m}$ - $373\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae located anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs appearing pointed in ventral view and with three pairs of setae on lateral margins; posterior margins of fourth coxae directed somewhat anteromedially; fourth coxae located in anterior half of ventral shield and far re-

moved from genital field; genital field subterminal and distinctly set off from the rest of the ventral shield (fig. 324); gonopore much longer than wide; many pairs of genital acetabula present; dorsal lengths of the palpal segments: P-I, $36\mu\text{m}$ - $37\mu\text{m}$; P-II, $66\mu\text{m}$ - $68\mu\text{m}$; P-III, $28\mu\text{m}$ - $31\mu\text{m}$; P-IV, $83\mu\text{m}$ - $87\mu\text{m}$; P-V, $34\mu\text{m}$ - $35\mu\text{m}$; figure 323 shows the proportions and chaetotaxy of the palp; capitulum $104\mu\text{m}$ - $110\mu\text{m}$ in length; chelicera $138\mu\text{m}$ - $149\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $71\mu\text{m}$ - $76\mu\text{m}$; I-Leg-5, $80\mu\text{m}$ - $87\mu\text{m}$; I-Leg-6, $80\mu\text{m}$ - $87\mu\text{m}$; figure 328 shows these segments.

Material Examined: NORTH ISLAND: 1 ♂, 2 ♀, from Waikohatu Stream on Rt 12 (in the Kauri Forest), Waipoua State Forest, May 29, 1981; 1 ♂, same area as preceding collection on Oct. 24, 1982; 1 ♀, Orauhora Stream on Rt 30, between Barryville and Benneydale, June 6, 1981; 1 ♀, same area as preceding collection on Oct. 31, 1982.

Discussion: The distinctive cauda of the male will distinguish that sex of the present species from all other notoaturins except the following species. See remarks under the latter. The female of the present species bears a superficial resemblance to that of *Tryssaturus spinipes*, but the body of the present species is more shouldered anteriorly and the genital field is more projecting (compare figures 318, 324). The ornamentation of the dorsal shield is completely different (compare figures 573, 574). See remarks under the following species for characteristics separating females of the two species in the present genus.

55. Neotryssaturus pallidus, new species

(Figs. 326, 327, 330-334, 336, 575)

Male: Integumental pigment absent but eyes well developed; dorsal shield $274\mu\text{m}$ in length, $297\mu\text{m}$ in width; anteromedial plate bearing the postocularia on small humps; one pair of glandularia on anterolateral platelets; one pair of glandularia located on small sclerites which lie free in the integument; two pairs of glandularia on the posteromedial plate; all glandularia of dorsal shield somewhat raised; integument of dorsum lacking the larger papillae characteristic of the previous species; ventral shield $395\mu\text{m}$ in length, $304\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae placed slightly anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs appearing pointed in ventral view and with several long setae on lateral margins; genital field located on a well developed cauda; cauda widest ($145\mu\text{m}$) at posterior end and narrowest at base of cauda; several pairs of acetabula present on ventral side of cauda; gonopore small and more or less terminal; numerous long setae on lateral margins of cauda, these best seen in lateral view (fig. 331); figures 332 and 336 show the morphology of the cauda; posterior suture lines of fourth coxae placed at right angles to long axis of body; dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$; P-II, $53\mu\text{m}$; P-III, $24\mu\text{m}$; P-IV, $69\mu\text{m}$; P-V, $31\mu\text{m}$; structure of palp as shown for female; capitulum $85\mu\text{m}$ in length; chelicera $110\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $60\mu\text{m}$; I-Leg-5, $62\mu\text{m}$; I-Leg-6, $69\mu\text{m}$; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $107\mu\text{m}$; IV-Leg-2, $67\mu\text{m}$; IV-Leg-3, $69\mu\text{m}$; IV-Leg-4, $83\mu\text{m}$; IV-Leg-5, $93\mu\text{m}$; IV-Leg-6, $97\mu\text{m}$; fourth leg not as highly modified as in the previous species, its structure better illustrated (fig. 327) than described.

Female: Structure of dorsum as described for male; dorsal shield $334\mu\text{m}$ ($330\mu\text{m}$ - $334\mu\text{m}$) in length, $304\mu\text{m}$ in width; ornamentation of dorsal shield consisting of small papillae of more or less uniform size (fig. 575); ventral shield

395 μ m in length, 312 μ m (312 μ m-319 μ m) in width; anterior coxae projecting; the glands of the fourth coxae placed anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs appearing pointed in ventral view and with three long setae on lateral margins; posterior suture lines of the fourth coxae placed at right angles to long axis of body; genital field subterminal and set off into what could be termed a short cauda (fig. 333); gonopore large; several pairs of genital acetabula present; dorsal lengths of the palpal segments: P-I, 28 μ m (27 μ m); P-II, 53 μ m (51 μ m-52 μ m); P-III, 24 μ m (24 μ m-25 μ m); P-IV, 67 μ m (65 μ m-69 μ m); P-V, 31 μ m (32 μ m); figure 330 shows the proportions and chaetotaxy of the palp; capitulum 86 μ m (85 μ m-86 μ m) in length; chelicera 107 μ m (107 μ m-111 μ m) in length; figure 334 shows a lateral view the the capitulum and chelicera; dorsal lengths of the distal segments of the first leg: I-Leg-4, 53 μ m (55 μ m-57 μ m); I-Leg-5, 59 μ m (58 μ m-61 μ m); I-Leg-6, 62 μ m (62 μ m-64 μ m); figure 326 shows these segments.

Holotype: Adult σ , from a tributary of the Tahakopa River on Tahakopa Rd, 5 km from Waikawa Valley Rd, South Island, Nov. 12, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: 2 f , Pourakino River at Pourakino Picnic Grounds in Longwood State Forest, on Harrington Rd south of Otautau, South Island, Nov. 13, 1982.

Discussions: The differences in morphology of the male body in the two species are numerous and are best compared by examining the illustrations (figs. 320, 336) and (figs. 329, 332). The fourth leg of the present species is less modified, with IV-Leg-4 not greatly lengthened and IV-Leg-5 not expanded at distal end. In females of the present species, the genital field is more distinctly set off from body and the first coxae do not extend as far beyond the body (compare figures 324, 333) Also, there are no enlarged, scattered papillae on the dorsal shield of the present species (compare figures 574, 575).

Genus PSEUDOTRYSSATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets bearing one pair of glandularia; a pair of glandularia on small sclerites between medial corners of anterolateral and posterolateral platelets and lateral edges of posteromedial plate; posteromedial plate bearing two pairs of glandularia; ornamentation of dorsal sclerites variable, they may be papillate, lined, reticulate or ornamentation may be nearly absent; a cauda absent, although the genital field area tends to be distinctly set off from remainder of ventral shield; with rare exceptions, an anterior pair of pore plates occupying a common concavity (fig. 603); coxae confined to anterior half of body; posterior suture lines of fourth coxae usually not evident but, if developed, they extend more or less at right angles to long axis of body; glands of the fourth coxae placed near the suture lines between third and fourth coxae; projections associated with insertions of fourth legs appearing somewhat pointed in ventral view and with a few setae laterally; coxal slots absent, legs not laterally compressed; P-II with a few small ventral papillae; P-IV of nearly same height along entire length and with a small but thickened terminal seta on medial side; I-Leg-1 only moderately elongated and with only a few setae; male fourth leg exhibiting a slight to moderate sexual dimorphism consisting of greater expansion of the leg segments and distal projections on certain segments; the leg setae do not exhibit sexual dimorphism.

Type Species: *Pseudotryssaturus indentatus* (Hopkins).

Discussion: *Pseudotryssaturus* shows a number of characteristics also pres-

ent in *Tryssaturus* and *Neotryssaturus*. These include a rather similar morphology of the coxal region, dorsal shield and mouthparts. There is also a tendency for the genital field region to be set off from the remainder of the body but only in *Neotryssaturus* is there a well developed cauda in the male. One difference found only in *Pseudotryssaturus* is the type of male sexual dimorphism of the fourth leg. In the present genus, this dimorphism is confined to proportions of the segments and the setae are unmodified. Another difference is the tendency for a pair of pore plates on each side to share a common concavity (acetabulum). It must be referred to as a tendency as, although there are usually a complete pair of these unusual acetabula on each side, there may occasionally be the double set of pore plates on only one side or rarely none of the acetabula are double.

KEY TO THE NEW ZEALAND SPECIES OF PSEUDOTRYSSATURUS

1. Ornamentation of the posteromedial plate of the dorsal shield consisting of distinct longitudinal lines (figs. 580, 583) or exhibiting varying degrees of loss of any surface ornamentation (figs. 581, 582); a pair of small but distinct apophyses near posteromedial suture lines between third and fourth coxae; males with a somewhat curved extension of IV-Leg-4 and, to a lesser degree, IV-Leg-3 (fig. 369) 2
 - Ornamentation of the posteromedial plate consisting of scattered papillae (fig. 584) or reticulations not arranged into distinct longitudinal lines (figs. 585-587); no apophyses present near posteromedial suture lines between third and fourth coxae; with little or no development of curved extensions on IV-Leg-3 and 4 4
2. Both anteromedial and posteromedial plates of dorsum unlined (fig. 581); body very narrow (figs. 382, 383) and eye pigment reduced
Pseudotryssaturus planus, new species ..(p. 79)
 Either only anteromedial plate lined (fig. 582) or both anteromedial and posteromedial plates lined (figs. 580, 583); body comparatively wider (figs. 367, 375); eye pigment well developed 3
3. Larger species (males 578 μ m-668 μ m in length, females 471 μ m-623 μ m in length); both anteromedial and posteromedial plates lined; integumental pigment present; segments of male fourth leg relatively long and IV-Leg-6 only slightly expanded distally (fig. 372)
Pseudotryssaturus indentatus (Hopkins) ..(p. 77)
 Smaller species (males 501 μ m-562 μ m in length, females 464 μ m-532 μ m in length); posteromedial plate may lack lines; no integumental pigment present; segments of male fourth leg relatively short and stocky, with IV-Leg-6 expanded distally (fig. 369)
Pseudotryssaturus anchistus, new species ..(p. 78)
4. Ornamentation of the posteromedial plate of the dorsum in the form of distinct papillae rather than reticulations (fig. 584)
Pseudotryssaturus papillidermis, new species ..(p. 81)
 Ornamentation of the posteromedial plate appearing as reticulations rather than papillae (figs. 585-587) 5

5. Female gonopore very small, its length less than one-third width of genital field (fig. 408); male ventral shield narrowed medially and with a patch of several short, thickened setae on each side posterior to epimeroglandularia 2 (fig. 401)

Pseudotryssaturus dapsilus, new species ... (p. 84)

Female gonopore larger, its length at least one-half width of the genital field (figs. 392, 398); male ventral shield not narrowed medially and with no thickened setae near epimeroglandularia 2 6

6. Posterior suture lines of fourth coxae tending to be well developed in female (and often in male) (fig. 392); female gonopore very large, its length approximately that of capitular bay; anteromedial plate with integumental pigmentation in both sexes; male genital field with a slight indentation posteromedially (fig. 388)

Pseudotryssaturus dictydermis, new species . (p. 81)

Posterior suture lines of fourth coxae mostly obliterated in both sexes (figs. 398, 400); female gonopore large but its length less than length of capitular bay; no integumental pigmentation; male genital field roundly pointed posteriorly (fig. 400)

Pseudotryssaturus acutus, new species .. (p. 83)

56. Pseudotryssaturus indentatus (Hopkins)

(Figs. 362-365, 367, 372, 580, 603)

Tryssaturus indentatus Hopkins, 1967. Trans. Royal Soc. New Zealand 10: 38.

Male: Eye and integumental pigmentation well developed; dorsal shield $456\mu\text{m}$ - $532\mu\text{m}$ in length, $319\mu\text{m}$ - $395\mu\text{m}$ in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; one pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; dorsal shield with numerous interconnected small papillae which are arranged in definite longitudinal lines on the posteromedial plate but more reticulate on other sclerites; this ornamentation shown in figure 367 but better indicated in the photograph of the female dorsal shield (fig. 580); ventral shield $578\mu\text{m}$ - $668\mu\text{m}$ in length, $342\mu\text{m}$ - $410\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae shifted to a position close to the suture lines between third and fourth coxae; projections associated with insertions of fourth legs bluntly pointed in ventral view and bearing several setae; posterior margins of fourth coxae obliterated except for an area immediately medial to the insertions of the fourth legs; small apophyses present medial to glands of fourth coxae; genital field set off from remainder of body; a ridge on each side extending far anterior to the genital field (fig. 363); gonopore somewhat angular and nearly terminal; genital acetabula numerous; one pair of anterior acetabula with doubled pore plates; dorsal lengths of the palpal segments: P-I, $31\mu\text{m}$ - $35\mu\text{m}$; P-II, $62\mu\text{m}$ - $67\mu\text{m}$; P-III, $31\mu\text{m}$ - $34\mu\text{m}$; P-IV, $79\mu\text{m}$ - $90\mu\text{m}$; P-V, $27\mu\text{m}$ - $31\mu\text{m}$; palp as shown for the female; capitulum $93\mu\text{m}$ - $100\mu\text{m}$ in length; chelicera $138\mu\text{m}$ - $149\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $87\mu\text{m}$ - $100\mu\text{m}$; I-Leg-5, $83\mu\text{m}$ - $97\mu\text{m}$; I-Leg-6, $93\mu\text{m}$ - $100\mu\text{m}$; dorsal lengths of the segments of the fourth leg (those of segments 2, 3 and 4 to distal end of distal projections): IV-Leg-1, $121\mu\text{m}$ - $145\mu\text{m}$; IV-Leg-2, $114\mu\text{m}$ - $124\mu\text{m}$; IV-Leg-3, $93\mu\text{m}$ - $97\mu\text{m}$; IV-Leg-4, $121\mu\text{m}$ - $141\mu\text{m}$; IV-Leg-5, $86\mu\text{m}$ - $100\mu\text{m}$; IV-Leg-6, $79\mu\text{m}$ - $86\mu\text{m}$; IV-Leg-6 not greatly expanded distally; figure 372 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for male; dorsal shield $380\mu\text{m}$ - $501\mu\text{m}$ in length, $273\mu\text{m}$ - $380\mu\text{m}$ in width; figure 580 shows the characteristic ornamentation of dorsal shield; ventral shield $471\mu\text{m}$ - $623\mu\text{m}$ in length, $289\mu\text{m}$ - $395\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae near suture lines between third and fourth coxae; projections associated with insertions of fourth legs bluntly pointed in ventral view and bearing a few setae; posterior suture lines of fourth coxae obliterated; small apophyses present somewhat posteromedial to glands of fourth coxae; gonopore subterminal and longer than wide; genital acetabula numerous and with a tendency for an anterior pair to have double pore plates; figure 365 shows the ventral shield; dorsal lengths of the palpal segments: P-I, $24\mu\text{m}$ - $31\mu\text{m}$; P-II, $55\mu\text{m}$ - $68\mu\text{m}$; P-III, $26\mu\text{m}$ - $36\mu\text{m}$; P-IV, $72\mu\text{m}$ - $86\mu\text{m}$; P-V, $24\mu\text{m}$ - $27\mu\text{m}$; figure 362 shows the structure of the palp; capitulum $87\mu\text{m}$ - $104\mu\text{m}$ in length; chelicera $128\mu\text{m}$ - $148\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $62\mu\text{m}$ - $86\mu\text{m}$; I-Leg-5, $67\mu\text{m}$ - $79\mu\text{m}$; I-Leg-6, $76\mu\text{m}$ - $86\mu\text{m}$; figure 364 shows these segments.

Material Examined: Over 1400 specimens of this species were taken. It was present in nearly two-thirds of the collections and was present throughout both North and South Islands. Because it is to be expected nearly everywhere, no specific localities are given.

Discussion: There is a large size variation, especially among females but, since there are all size gradations, even within a single population, it seems very probable they all belong to a single species.

57. Pseudotryssaturus anchistus, new species

(Figs. 366, 368-371, 373-376, 582, 583)

Male: Integumental pigment absent, eye pigment slightly reduced; dorsal shield $422\mu\text{m}$ ($410\mu\text{m}$ - $456\mu\text{m}$) in length, $273\mu\text{m}$ ($258\mu\text{m}$ - $297\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; a pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; striations of dorsal shield are variable; anteromedial plate typically with well developed striations (fig. 376) but posteromedial plate varying from no striations to completely covered with striations; this ornamentation best seen in the photographs of the female dorsal shield (figs. 582, 583); ventral shield $532\mu\text{m}$ ($501\mu\text{m}$ - $562\mu\text{m}$) in length, $288\mu\text{m}$ ($274\mu\text{m}$ - $304\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae located near suture lines between third and fourth coxae; projections associated with insertions of fourth legs bluntly pointed in ventral view and bearing several setae; posterior suture lines of fourth coxae obliterated; small apophyses present somewhat posteromedial to glands of fourth coxae; genital field set off from remainder of body; a ridge on either side extending anteriorly from the genital field (but not nearly as far anteriorly as in *indentatus*); gonopore somewhat angular and more or less terminal; genital acetabula numerous; one anteromedially located pair of acetabula with doubled pore plates; figure 368 shows a posteroventral view of the genital field; dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$ ($27\mu\text{m}$ - $34\mu\text{m}$); P-II, $62\mu\text{m}$ ($60\mu\text{m}$ - $62\mu\text{m}$); P-III, $27\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); P-IV, $78\mu\text{m}$ ($76\mu\text{m}$ - $83\mu\text{m}$); P-V, $28\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); palp similar to that of the female; capitulum $90\mu\text{m}$ ($86\mu\text{m}$ - $93\mu\text{m}$) in length; chelicera $131\mu\text{m}$ ($118\mu\text{m}$ - $138\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $83\mu\text{m}$ ($76\mu\text{m}$ - $90\mu\text{m}$); I-Leg-5, $93\mu\text{m}$ ($87\mu\text{m}$ - $96\mu\text{m}$); I-Leg-6, $104\mu\text{m}$ ($93\mu\text{m}$ - $107\mu\text{m}$); dorsal lengths of the segments of the fourth leg (those of segments 2, 3 and 4 to

distal end of distal projections): IV-Leg-1, $104\mu\text{m}$ ($93\mu\text{m}$ - $114\mu\text{m}$); IV-Leg-2, $93\mu\text{m}$ ($86\mu\text{m}$ - $93\mu\text{m}$); IV-Leg-3, $83\mu\text{m}$ ($83\mu\text{m}$ - $90\mu\text{m}$); IV-Leg-4, $111\mu\text{m}$ ($107\mu\text{m}$ - $121\mu\text{m}$); IV-Leg-5, $86\mu\text{m}$ ($80\mu\text{m}$ - $93\mu\text{m}$); IV-Leg-6, $83\mu\text{m}$ ($76\mu\text{m}$ - $83\mu\text{m}$); leg segments comparatively stocky, with IV-Leg-6 noticeably expanded distally (fig. 369).

Female: Dorsum as described for male; dorsal shield $425\mu\text{m}$ ($388\mu\text{m}$ - $440\mu\text{m}$) in length, $278\mu\text{m}$ ($258\mu\text{m}$ - $297\mu\text{m}$) in width; figures 582 and 583 show the variation in ornamentation of the dorsal shield; ventral shield $509\mu\text{m}$ ($468\mu\text{m}$ - $532\mu\text{m}$) in length, $288\mu\text{m}$ ($258\mu\text{m}$ - $297\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs bluntly pointed when they are viewed ventrally and bearing a few setae; posterior suture lines of fourth coxae obliterated; small apophyses present somewhat posteromedial to glands of fourth coxae; gonopore subterminal and longer than wide; genital acetabula numerous; with a tendency to have a pair of anterior acetabula with doubled pore plates; figure 366 shows a posteroventral view of genital field; dorsal lengths of the palpal segments: P-I, $29\mu\text{m}$ ($26\mu\text{m}$ - $31\mu\text{m}$); P-II, $59\mu\text{m}$ ($54\mu\text{m}$ - $62\mu\text{m}$); P-III, $27\mu\text{m}$ ($26\mu\text{m}$ - $31\mu\text{m}$); P-IV, $72\mu\text{m}$ ($69\mu\text{m}$ - $79\mu\text{m}$); P-V, $28\mu\text{m}$ ($26\mu\text{m}$ - $31\mu\text{m}$); figure 371 illustrates the palp; capitulum $88\mu\text{m}$ ($80\mu\text{m}$ - $90\mu\text{m}$) in length; chelicera $131\mu\text{m}$ ($117\mu\text{m}$ - $134\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $74\mu\text{m}$ ($66\mu\text{m}$ - $76\mu\text{m}$); I-Leg-5, $79\mu\text{m}$ ($72\mu\text{m}$ - $79\mu\text{m}$); I-Leg-6, $89\mu\text{m}$ ($80\mu\text{m}$ - $93\mu\text{m}$); figure 370 illustrates these segments.

Holotype: Adult σ , from Adamson Creek on Rt 6, between Lake Ianthe and Wanganui, South Island, Nov. 9, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: SOUTH ISLAND: 1 σ , from Four Mile River on Rt. 6, between Charleston and Tiromoana, Nov. 8, 1982; 4 σ , 8 f , same data as holotype; 12 σ , 7 f , Potters Creek on Rt 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 1 f , Cole Creek on Rt 6, between Lake Moeraki and Haast, Nov. 10, 1982; 1 f , from Boyd Creek on Rt 94, 76 km south of Milford Sound, Nov. 14, 1982; 1 f , Pariwhakaoho River on Rt 60, 14 km northwest of Takaka, Nov. 24, 1982.

Discussion: The present species is most closely related to the following species, both of which differ most noticeably from the preceding species, *P. indentatus*, in lacking integumental pigmentation and in having the male IV-Leg-6 greatly expanded distally.

58. Pseudotryssaturus planus, new species

(Figs. 377-380, 382, 383, 581)

Male: Integumental pigmentation absent, eye pigment reduced; dorsal shield $410\mu\text{m}$ ($410\mu\text{m}$ - $441\mu\text{m}$) in length, $243\mu\text{m}$ ($243\mu\text{m}$ - $273\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with a pair of glandularia; one pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; both anteromedial and posteromedial plates without longitudinal striations (fig. 377); ventral shield $502\mu\text{m}$ ($516\mu\text{m}$ - $555\mu\text{m}$) in length, $251\mu\text{m}$ ($258\mu\text{m}$ - $273\mu\text{m}$) in width; anterior coxae broader and less projecting than in the previous species; glands of the fourth coxae placed near suture lines between third and fourth coxae; small apophyses present posteromedial to these glands; projections associated with insertions of fourth legs blunt and bearing two setae on lateral margins; posterior suture lines of fourth

coxae obliterated; genital field slightly set off from remainder of body; short ridges on each side extending anteriorly from genital field; gonopore somewhat angular and more or less terminal; genital acetabula numerous; one pair of anteriorly located acetabula typically with doubled pore plates; figure 383 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $26\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); P-II, $59\mu\text{m}$ ($57\mu\text{m}$ - $65\mu\text{m}$); P-III, $31\mu\text{m}$ ($28\mu\text{m}$ - $31\mu\text{m}$); P-IV, $72\mu\text{m}$ ($69\mu\text{m}$ - $72\mu\text{m}$); P-V, $27\mu\text{m}$ ($26\mu\text{m}$ - $27\mu\text{m}$); palp similar to that illustrated for the female; capitulum $86\mu\text{m}$ ($79\mu\text{m}$ - $86\mu\text{m}$) in length, chelicera $128\mu\text{m}$ ($114\mu\text{m}$ - $124\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $79\mu\text{m}$ ($79\mu\text{m}$ - $86\mu\text{m}$); I-Leg-5, $86\mu\text{m}$ ($86\mu\text{m}$ - $90\mu\text{m}$); I-Leg-6, $97\mu\text{m}$ ($90\mu\text{m}$ - $93\mu\text{m}$); dorsal lengths of the segments of the fourth leg (those of segments 2, 3 and 4 to distal end of distal projection): IV-Leg-1, $93\mu\text{m}$ ($100\mu\text{m}$ - $107\mu\text{m}$); IV-Leg-2, $76\mu\text{m}$ ($83\mu\text{m}$ - $86\mu\text{m}$); IV-Leg-3, $80\mu\text{m}$ ($83\mu\text{m}$ - $90\mu\text{m}$); IV-Leg-4, $93\mu\text{m}$ ($103\mu\text{m}$ - $107\mu\text{m}$); IV-Leg-5, $85\mu\text{m}$ ($83\mu\text{m}$ - $87\mu\text{m}$); IV-Leg-6, $83\mu\text{m}$ ($69\mu\text{m}$ - $80\mu\text{m}$); figure 380 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for male; dorsal shield $380\mu\text{m}$ ($380\mu\text{m}$ - $403\mu\text{m}$) in length, $258\mu\text{m}$ ($243\mu\text{m}$ - $258\mu\text{m}$) in width; figure 581 illustrates the ornamentation of the dorsal sclerites; ventral shield $471\mu\text{m}$ ($456\mu\text{m}$ - $501\mu\text{m}$) in length, $243\mu\text{m}$ ($243\mu\text{m}$ - $266\mu\text{m}$) in width; anterior coxae wider and less projecting than in the previous species; glands of the fourth coxae located near suture lines between third and fourth coxae; small apophyses present posteromedial to these glands; projections associated with insertions of fourth legs bluntly pointed in ventral view and bearing two setae on each lateral margin; posterior suture lines of fourth coxae obliterated; gonopore subterminal and somewhat longer than wide; genital acetabula numerous, with a tendency for an anteromedial pair to have doubled pore plates; figure 382 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$ ($27\mu\text{m}$ - $28\mu\text{m}$); P-II, $58\mu\text{m}$ ($52\mu\text{m}$ - $56\mu\text{m}$); P-III, $31\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); P-IV, $71\mu\text{m}$ ($67\mu\text{m}$ - $69\mu\text{m}$); P-V, $27\mu\text{m}$ ($27\mu\text{m}$ - $28\mu\text{m}$); figure 379 shows the structure of the palp; capitulum $81\mu\text{m}$ ($81\mu\text{m}$ - $83\mu\text{m}$) in length, chelicera $124\mu\text{m}$ ($114\mu\text{m}$ - $124\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $67\mu\text{m}$ ($69\mu\text{m}$ - $70\mu\text{m}$); I-Leg-5, $69\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$); I-Leg-6, $76\mu\text{m}$ ($83\mu\text{m}$); figure 378 shows these segments.

Holotype: Adult ♂, from Te Whaiau Stream at junction of Rt 47 and Rotoaria Rd, North Island, June 5, 1981.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 1 ♀, from stream at Opato Bridge in "Gorge" southeast of Opotiki, June 3, 1981; 2 ♀, same data as holotype; 1 ♀, Torere River at Torere, on Rt 35 north of Opotiki, Oct. 28, 1982; 1 ♀, stream at Owiritoa Bridge on Rt 2, in the "Gorge" south of Opotiki, Oct. 29, 1982; 2 ♀, stream at Omaukoro Bridge on Rt 2, in "Gorge" south of Opotiki, Oct. 29, 1982; 1 ♂, from a stream at Gerrards Bridge on Rt 2, in "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 2 ♀, from a tributary of Wakamarina River 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 1 ♀, from a tributary of Whangamo River slightly west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 6, 1982; 1 ♂, 1 ♀, Kaituna River on Rt 6, 5 km south of Havelock, Nov. 22, 1982.

Discussion: This species is most closely related to the preceding, *P. anchistus*. Both are interstitial species with the integumental pigment absent and IV-Leg-6 of the male fourth leg expanded distally (figs. 369, 380). Differences between the two species include broader anterior coxae and a proportionally narrower body in the present species and both anteromedial and posteromedial plates lack striations in *planus*. Based on present knowledge of distributions, *P. planus* is confined to North Island and the extreme northern portion of South Island. *P. anchistus* has been only collected farther south on South Island.

59. Pseudotryssaturus papillidermis, new species

(Figs. 381, 384, 385, 387, 389, 390, 584)

Male: Integumental pigmentation absent, eye pigment developed; dorsal shield $460\mu\text{m}$ ($456\mu\text{m}$) in length, $384\mu\text{m}$ ($365\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; a pair of small glandularia sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; ornamentation of the dorsum consisting of scattered papillae which do not form distinct reticulations (fig. 584); ventral shield $608\mu\text{m}$ ($592\mu\text{m}$) in length, $395\mu\text{m}$ ($380\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae placed near suture lines between third and the fourth coxae; no apophyses (typical of the previous three species) present posteromedial to these glands; projections associated with insertions of fourth legs somewhat truncate; posterior suture lines of fourth coxae obliterated; genital field distinctly set off from remainder of body; gonopore oval and subterminal; genital field with a distinct medial indentation posteriorly; genital acetabula numerous; one pair of anterior acetabula typically with doubled pore plates; figure 390 shows the ventral shield; dorsal lengths of the palpal segments: P-I, $26\mu\text{m}$ ($31\mu\text{m}$); P-II, $60\mu\text{m}$ ($65\mu\text{m}$); P-III, $29\mu\text{m}$ ($28\mu\text{m}$); P-IV, $80\mu\text{m}$ ($88\mu\text{m}$); P-V, $30\mu\text{m}$ ($31\mu\text{m}$); palp as shown for the female; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $117\mu\text{m}$ ($131\mu\text{m}$); IV-Leg-2, $93\mu\text{m}$ ($90\mu\text{m}$); IV-Leg-3, $86\mu\text{m}$ ($90\mu\text{m}$); IV-Leg-4, $89\mu\text{m}$ ($93\mu\text{m}$); IV-Leg-5, $86\mu\text{m}$; IV-Leg-6, $86\mu\text{m}$ ($87\mu\text{m}$); fourth leg relatively unmodified and without the distal projections found in males of the previous species; figure 381 shows the structure of the fourth leg.

Female: Dorsum as described for male (fig. 584); dorsal shield $464\mu\text{m}$ ($426\mu\text{m}$ - $456\mu\text{m}$) in length, $380\mu\text{m}$ ($354\mu\text{m}$ - $388\mu\text{m}$) in width; ventral shield $601\mu\text{m}$ ($550\mu\text{m}$ - $608\mu\text{m}$) in length, $384\mu\text{m}$ ($365\mu\text{m}$ - $399\mu\text{m}$) in width; ventral shield, except for genital field region, as described for male; gonopore subterminal and longer than wide; genital acetabula numerous; an anteromedial pair of acetabula typically with doubled pore plates; figure 385 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $31\mu\text{m}$ ($28\mu\text{m}$ - $29\mu\text{m}$); P-II, $65\mu\text{m}$ ($60\mu\text{m}$ - $62\mu\text{m}$); P-III, $29\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); P-IV, $81\mu\text{m}$ ($76\mu\text{m}$ - $83\mu\text{m}$); P-V, $31\mu\text{m}$ ($28\mu\text{m}$ - $30\mu\text{m}$); figure 389 shows the structure of the palp; capitulum $90\mu\text{m}$ ($87\mu\text{m}$ - $91\mu\text{m}$) in length; chelicera $131\mu\text{m}$ ($128\mu\text{m}$ - $135\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $76\mu\text{m}$ ($72\mu\text{m}$ - $79\mu\text{m}$); I-Leg-5, $79\mu\text{m}$ ($74\mu\text{m}$ - $79\mu\text{m}$); I-Leg-6, $83\mu\text{m}$ ($83\mu\text{m}$ - $86\mu\text{m}$); figure 387 illustrates these segments.

Holotype: Adult ♂, from the Pariwhakaoho River on Rt 60, 14 km northwest of Takaka, South Island, Nov. 24, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: SOUTH ISLAND: 1 ♂, Potters Creek on Rt 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 2 ♀, same data as holotype.

Discussion: The papillate dorsal ornamentation is diagnostic for the present species.

60. Pseudotryssaturus dictydermis, new species

(Figs. 386, 388, 391-393, 395, 587)

Male: Both integumental and eye pigmentation developed; dorsal shield $425\mu\text{m}$ ($395\mu\text{m}$ - $425\mu\text{m}$) in length, $300\mu\text{m}$ ($282\mu\text{m}$ - $304\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandu-

laria; a pair of glandularia on small sclerites lying free in the integument; posteromedial plate bearing two pairs of glandularia; ornamentation of the dorsal shield consisting of a closely set pattern of reticulations (figs. 386, 587); ventral shield $517\mu\text{m}$ ($490\mu\text{m}$ - $532\mu\text{m}$) in length, $312\mu\text{m}$ ($289\mu\text{m}$ - $319\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae located near suture lines between third and fourth coxae; no apophyses present posteromedial to these glands; projections associated with insertions of fourth legs roundly pointed in ventral view; posterior suture lines of fourth coxae well indicated; genital field distinctly set off from remainder of body; gonopore oval and subterminal; genital field with a slight median indentation posteriorly; genital acetabula numerous, with one pair of acetabula typically with doubled pore plates; figure 388 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $28\mu\text{m}$ ($26\mu\text{m}$ - $28\mu\text{m}$); P-II, $65\mu\text{m}$ ($59\mu\text{m}$ - $66\mu\text{m}$); P-III, $27\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); P-IV, $81\mu\text{m}$ ($78\mu\text{m}$ - $80\mu\text{m}$); P-V, $25\mu\text{m}$ ($26\mu\text{m}$ - $27\mu\text{m}$); palp as shown for the female; capitulum $79\mu\text{m}$ ($79\mu\text{m}$ - $86\mu\text{m}$) in length; chelicera $126\mu\text{m}$ ($124\mu\text{m}$ - $131\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $79\mu\text{m}$ ($76\mu\text{m}$ - $80\mu\text{m}$); I-Leg-5, $79\mu\text{m}$ ($76\mu\text{m}$ - $79\mu\text{m}$); I-Leg-6, $87\mu\text{m}$ ($89\mu\text{m}$ - $90\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-1, $97\mu\text{m}$ ($90\mu\text{m}$ - $100\mu\text{m}$); IV-Leg-2, $79\mu\text{m}$ ($69\mu\text{m}$ - $83\mu\text{m}$); IV-Leg-3, $72\mu\text{m}$ ($66\mu\text{m}$ - $76\mu\text{m}$); IV-Leg-4, $76\mu\text{m}$ ($76\mu\text{m}$ - $83\mu\text{m}$); IV-Leg-5, $76\mu\text{m}$ ($72\mu\text{m}$ - $79\mu\text{m}$); IV-Leg-6, $86\mu\text{m}$ ($83\mu\text{m}$ - $89\mu\text{m}$); fourth leg relatively unmodified; figure 395 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for male; figure 587 illustrates the ornamentation of the dorsum; dorsal shield $441\mu\text{m}$ ($426\mu\text{m}$ - $470\mu\text{m}$) in length, $334\mu\text{m}$ ($334\mu\text{m}$ - $350\mu\text{m}$) in width; ventral shield $532\mu\text{m}$ ($517\mu\text{m}$ - $562\mu\text{m}$) in length, $338\mu\text{m}$ ($338\mu\text{m}$ - $364\mu\text{m}$) in width; ventral shield, except for genital field region, as described for the male; gonopore proportionally very large and is subterminal; genital acetabula numerous with one anterior pair often doubled, but not in the individual illustrated (fig. 392); dorsal lengths of the palpal segments: P-I, $27\mu\text{m}$ ($27\mu\text{m}$ - $28\mu\text{m}$); P-II, $67\mu\text{m}$ ($62\mu\text{m}$ - $71\mu\text{m}$); P-III, $28\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); P-IV, $83\mu\text{m}$ ($81\mu\text{m}$ - $85\mu\text{m}$); P-V, $27\mu\text{m}$ ($26\mu\text{m}$ - $27\mu\text{m}$); figure 391 shows the proportions and chaetotaxy of the palp; capitulum $90\mu\text{m}$ ($83\mu\text{m}$ - $93\mu\text{m}$) in length, chelicera $142\mu\text{m}$ ($141\mu\text{m}$ - $145\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $72\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$); I-Leg-5, $76\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$); I-Leg-6, $78\mu\text{m}$ ($80\mu\text{m}$ - $86\mu\text{m}$); figure 393 illustrates these segments.

Holotype: Adult ♂, MacLennan River at bridge on Aurora Creek Rd (Catlin State Forest area) between Puketiro and Rt 92, South Island, Nov. 12, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: SOUTH ISLAND: 7 ♂, 26 ♀, same data as holotype; 1 ♂, 1 ♀, from a tributary of the Tahakopa River on Tahakopa Rd, 5 km from Waikawa Valley Rd, Nov. 12, 1982; 1 ♂, 3 ♀, Pourakino River at Pourakino Picnic Grounds (in Longwood State Forest), on Harrington Rd south of Otautau, Nov. 13, 1982; 3 ♂, 4 ♀, from a small stream on Rt 94 west of Mossburn, Nov. 13, 1982; 4 ♀, from Flaxy Creek near the Manapouri fork off Rt 94, Nov. 13, 1982.

Discussion: The present species, the preceding species, and the following species, form a group of closely related mites characterized by little or no sexual dimorphism of the male fourth leg, lack of apophyses on the ventral shield and a non-lined integumental ornamentation. In addition to characters given in the key to separate these three species, the present taxon is the only one with an integumental color pattern. All members of this species group are apparently confined to South Island and the present species has the most extreme southern range.

61. Pseudotryssaturus acutus, new species

(Figs. 394, 396-400, 586)

Male: Integumental pigment absent, eye pigment developed; dorsal shield $426\mu\text{m}$ ($395\mu\text{m}$ - $456\mu\text{m}$) in length, $342\mu\text{m}$ ($308\mu\text{m}$ - $380\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with a pair of glandularia; one pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield consisting of low papillae which are united to form a reticulate network as shown for the female (fig. 586); ventral shield $577\mu\text{m}$ ($536\mu\text{m}$ - $653\mu\text{m}$) in length, $365\mu\text{m}$ ($312\mu\text{m}$ - $410\mu\text{m}$) in width; anterior coxae projection; glands of the fourth coxae placed near suture lines between third and fourth coxae; no apophyses present posteromedial to these glands; projections associated with openings for insertion of fourth legs relatively broad and truncate; posterior suture lines of fourth coxae obliterated; genital field distinctly set off from remainder of body; gonopore small, longer than wide, and subterminal; no median indentation at posterior end of body (fig. 400); genital acetabula numerous, one pair of acetabula tending to have doubled pore plates; dorsal lengths of the palpal segments: P-I, $31\mu\text{m}$ ($31\mu\text{m}$ - $35\mu\text{m}$); P-II, $66\mu\text{m}$ ($62\mu\text{m}$ - $69\mu\text{m}$); P-III, $28\mu\text{m}$ ($26\mu\text{m}$ - $34\mu\text{m}$); P-IV, $79\mu\text{m}$ ($76\mu\text{m}$ - $85\mu\text{m}$); P-V, $29\mu\text{m}$ ($26\mu\text{m}$ - $28\mu\text{m}$); palp as shown for the female; capitulum $104\mu\text{m}$ ($90\mu\text{m}$ - $107\mu\text{m}$) in length; chelicera $138\mu\text{m}$ ($135\mu\text{m}$ - $160\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $86\mu\text{m}$ ($83\mu\text{m}$ - $87\mu\text{m}$); I-Leg-5, $90\mu\text{m}$ ($86\mu\text{m}$ - $90\mu\text{m}$); I-Leg-6, $93\mu\text{m}$; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $100\mu\text{m}$ ($97\mu\text{m}$ - $111\mu\text{m}$); IV-Leg-2, $76\mu\text{m}$ ($72\mu\text{m}$ - $93\mu\text{m}$); IV-Leg-3, $79\mu\text{m}$ ($74\mu\text{m}$ - $76\mu\text{m}$); IV-Leg-4, $86\mu\text{m}$ ($81\mu\text{m}$ - $93\mu\text{m}$); IV-Leg-5, $83\mu\text{m}$ ($79\mu\text{m}$ - $85\mu\text{m}$); IV-Leg-6, $90\mu\text{m}$ ($86\mu\text{m}$); fourth leg relatively unmodified; figure 394 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for male (fig. 586); dorsal shield $440\mu\text{m}$ ($410\mu\text{m}$ - $502\mu\text{m}$) in length, $364\mu\text{m}$ ($319\mu\text{m}$ - $395\mu\text{m}$) in width; ventral shield $562\mu\text{m}$ ($532\mu\text{m}$ - $631\mu\text{m}$) in length, $365\mu\text{m}$ - $410\mu\text{m}$) in width; ventral shield, except for genital field region, as described for male; gonopore relatively large and subterminal; genital acetabula numerous; anterior pair of acetabula typically with a double pore plate; figure 398 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $29\mu\text{m}$ ($27\mu\text{m}$ - $34\mu\text{m}$); P-II, $66\mu\text{m}$ ($62\mu\text{m}$ - $69\mu\text{m}$); P-III, $30\mu\text{m}$ ($28\mu\text{m}$ - $32\mu\text{m}$); P-IV, $83\mu\text{m}$ ($76\mu\text{m}$ - $86\mu\text{m}$); P-V, $28\mu\text{m}$ ($24\mu\text{m}$ - $28\mu\text{m}$); figure 397 shows the structure of the palp; capitulum $100\mu\text{m}$ ($93\mu\text{m}$ - $104\mu\text{m}$) in length, chelicera $145\mu\text{m}$ ($142\mu\text{m}$ - $155\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $78\mu\text{m}$ ($72\mu\text{m}$ - $81\mu\text{m}$); I-Leg-5, $83\mu\text{m}$ ($76\mu\text{m}$ - $81\mu\text{m}$); I-Leg-6, $93\mu\text{m}$ ($79\mu\text{m}$ - $90\mu\text{m}$); figure 399 illustrates these segments.

Holotype: Adult ♂, from Adamson Creek on Rt 6, between Lake Ianthe and Wanganui, South Island, Nov. 9, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: SOUTH ISLAND: 1 ♂, from a tributary of the Motupiko River on Rt 6, between Korere and Glenhope, Nov. 7, 1982; 3 ♂, Whale Creek on Rt 6, west of Murchison, Nov. 7, 1982; 1 ♂, Kararoa Creek on Rt. 6, between Barrytown and Nine Mile Village, Nov. 8, 1982; 2 ♂, 8 ♀, same data as holotype; 7 ♂, 9 ♀, Potters Creek on Rt 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 1 ♂, tributary of Motupiko River on Rt 6, between Korere and Glenhope, Nov. 25, 1982; 5 ♂, 3 ♀, Hope River on Rt 6, between Glenhope and Kawatiri, Nov. 25, 1982.

62. Pseudotryssaturus dapsilus, new species

(Figs. 401-404, 406, 408, 585)

Male: Eye pigment well developed; integumental pigment typically well developed to produce darkly colored individuals, but this pigment exhibiting various degrees of lightening to produce nearly colorless individuals; dorsal shield $532\mu\text{m}$ ($486\mu\text{m}$ - $562\mu\text{m}$) in length, $319\mu\text{m}$ ($289\mu\text{m}$ - $334\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; a pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield consists of closely set reticulations as shown for the female (fig. 585); ventral shield $654\mu\text{m}$ ($623\mu\text{m}$ - $714\mu\text{m}$) in length, $364\mu\text{m}$ ($327\mu\text{m}$ - $403\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae located near suture lines between third and fourth coxae; no apophyses located posteromedial to these glands; central area of ventral shield decidedly concave; projections associated with the insertions of fourth legs extending lateral to edges of ventral shield; with numerous setae on and anterior to these projections; posterior suture lines of fourth coxae obliterated; two groups of short, thickened setae present posterior to the epimeroglandularia 2; genital field distinctly set off from remainder of body; gonopore small and appearing nearly circular in ventral view; a median notch present posterior to genital field; genital acetabula numerous, with an anterior pair tending to have doubled pore plates; dorsal lengths of the palpal segments: P-I, $31\mu\text{m}$ ($28\mu\text{m}$ - $34\mu\text{m}$); P-II, $73\mu\text{m}$ ($72\mu\text{m}$ - $83\mu\text{m}$); P-III, $26\mu\text{m}$ ($24\mu\text{m}$ - $29\mu\text{m}$); P-IV, $85\mu\text{m}$ ($83\mu\text{m}$ - $94\mu\text{m}$); P-V, $29\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); palp as shown for the female; capitulum $100\mu\text{m}$ ($93\mu\text{m}$ - $104\mu\text{m}$) in length; chelicera $159\mu\text{m}$ ($145\mu\text{m}$ - $166\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $88\mu\text{m}$ ($93\mu\text{m}$ - $98\mu\text{m}$); I-Leg-5, $90\mu\text{m}$ ($93\mu\text{m}$ - $104\mu\text{m}$); I-Leg-6, $100\mu\text{m}$ ($104\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-1, $141\mu\text{m}$ ($131\mu\text{m}$ - $155\mu\text{m}$); IV-Leg-2, $121\mu\text{m}$ ($124\mu\text{m}$ - $145\mu\text{m}$); IV-Leg-3, $93\mu\text{m}$ ($90\mu\text{m}$ - $100\mu\text{m}$); IV-Leg-4, $128\mu\text{m}$ ($121\mu\text{m}$ - $142\mu\text{m}$); IV-Leg-5, $93\mu\text{m}$ ($94\mu\text{m}$ - $100\mu\text{m}$); IV-Leg-6, $76\mu\text{m}$ ($77\mu\text{m}$ - $83\mu\text{m}$); figure 404 shows the proportions and chaetotaxy of the fourth leg.

Female: Dorsum as described for male, but with even a greater tendency for the color to be light; dorsal shield $460\mu\text{m}$ ($464\mu\text{m}$ - $540\mu\text{m}$) in length, $349\mu\text{m}$ ($334\mu\text{m}$ - $395\mu\text{m}$) in width; dorsal shield as described for male; figure 585 shows the integumental ornamentation and color pattern of one of the darker specimens; ventral shield $552\mu\text{m}$ ($562\mu\text{m}$ - $684\mu\text{m}$) in length, $334\mu\text{m}$ ($334\mu\text{m}$ - $395\mu\text{m}$) in width; anterior coxae projecting; glands of the fourth coxae placed near suture lines between third and fourth coxae; no apophyses present posteromedial to these glands; projections associated with insertions of fourth legs bluntly pointed, with several setae on and somewhat anterior to these projections; posterior suture lines of fourth coxae obliterated; genital field distinctly set off from rest of body; gonopore relatively small and oval; a medial notch present at posterior end; genital acetabula numerous, with an anterior pair tending to be double; figure 408 shows the ventral shield; dorsal lengths of the palpal segments: P-I, $28\mu\text{m}$ ($31\mu\text{m}$ - $34\mu\text{m}$); P-II, $69\mu\text{m}$ ($69\mu\text{m}$ - $83\mu\text{m}$); P-III, $24\mu\text{m}$ ($24\mu\text{m}$ - $29\mu\text{m}$); P-IV, $80\mu\text{m}$ ($78\mu\text{m}$ - $90\mu\text{m}$); P-V, $28\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); figure 406 shows the proportions and chaetotaxy of the palp; capitulum $90\mu\text{m}$ ($92\mu\text{m}$ - $111\mu\text{m}$) in length; chelicera $155\mu\text{m}$ ($155\mu\text{m}$ - $179\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $76\mu\text{m}$ ($73\mu\text{m}$ - $83\mu\text{m}$); I-Leg-5, $78\mu\text{m}$ ($76\mu\text{m}$ - $80\mu\text{m}$); I-Leg-6, $83\mu\text{m}$ ($79\mu\text{m}$ - $89\mu\text{m}$); figure 402 shows these segments.

Holotype: Adult ♂, White Rock River (southwest of Timaru), where Cliffs

Rd branches off Pareora-Cave Rd, South Island, Nov. 18, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 1 ♀, Waima River on Rt 12, 7 km west of Taheke, May 30, 1981; 9 ♂, 3 ♀, stream at Twin Bridges, near Nukutawhiti, May 30, 1981; 10 ♂, 5 ♀, stream at Sandy's Bridge on Rt 2, between Opotiki and Gisborne, June 3, 1981; 3 ♂, 2 ♀, stream at Opato Bridge, 67 km southeast of Opotiki, June 3, 1981; 6 ♂, 8 ♀, Mangamuka River on Rt 1 (northeast of town), approx 3 km north of forest reserve, Oct. 19, 1982; 1 ♀, Pohue Stream at Waiomu (in the Coromandel Peninsula), Oct. 26, 1982; 1 ♂, 12 ♀, Tapu River, 1 km east of Tapu (Coromandel Peninsula), Oct. 27, 1982; 1 ♂, 1 ♀, tributary of Waiwawa River at AA Rest Stop, 3km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 6 ♂, 8 ♀, Boom Stream on Rt 25, between Hakaa and Whangamata, Oct. 27, 1982; 8 ♂, 13 ♀, Torere River at Torere, on Rt 35 north of Opotiki, Oct. 28, 1982; 2 ♂, 1 ♀, stream 1 km north of Tohere (east of Opotiki on Rt 35), Oct. 29, 1982; 63 ♂, 184 ♀, stream at Owiritoa Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 24 ♂, 47 ♀, stream at Omaukoro Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 101 ♂, 196 ♀, stream at Opato Bridge area (at rest stop) on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 79 ♂, 81 ♀, from stream at Sandy's Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 35 ♂, 28 ♀, stream at Gerrards Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 4 ♂, Mangatepopo Stream on Rt 47, between National Park and Rotoaira Rd cutoff (southwest of Lake Taupo), Nov. 3, 1982; SOUTH ISLAND: 5 ♂, 45 ♀, Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, Nov. 6, 1982; 8 ♂, 17 ♀, Graham Stream on Rt 6, at picnic grounds 8 km northeast of Whangamoa Saddle, Nov. 6, 1982; 11 ♂, 39 ♀, tributary of the Motupiko River, on Rt 6 between Korere and Glenhope, Nov. 7, 1982; 15 ♂, 13 ♀, Shag River near its headwaters, on Rt 85, 2 km west of Pigroot Summit (Central Otago), Nov. 16, 1982; 33 ♂, 71 ♀, same data as holotype; 93 ♂, 101 ♀, Rocky Gully Stream on Rt 8, between Cave and Fairlie (west of Timaru), Nov. 18, 1982; 24 ♂, 60 ♀, Oaro River at Oaro, on Rt 1 approx 20 km south of Kaikoura, Nov. 19, 1982; 12 ♂, 15 ♀, Irongate Stream on Rt 1, 24 km north of Kaikoura, Nov. 21, 1982; 29 ♂, 51 ♀, Kaituna River on Rt 6, 5 km south of Havelock, Nov. 22, 1982; 128 ♂, 180 ♀, Whangamoa River on Rt 6, approx 5 km northeast of Whangamoa Saddle, Nov. 23, 1982.

Genus EVIDATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets with one pair of glandularia; typically, glandularia 2 are completely absent, but in one individual (fig. 338), there is a small, free glandularia sclerite on one side; posteromedial plate bearing two pairs of glandularia; integument very rugose; a tripartite ridge present near posterior end of posteromedial plate; this ridge loops around the posterior glandularia and extends posteriorly near the midline (figs. 576, 577); first three pairs of coxae projecting; capitular bay a narrow V-shape; posterior margins of fourth coxae extending anteromedially; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs well developed and truncate; excretory pore on a large terminal tubercle; P-II without ventral papillae; P-IV bulging ventrally; no sexual dimorphism of the legs.

Type Species: *Evidaturus exilis*, new species

Discussion: The loss of the "free" glandularia (or the tendency to lose it, since it is present on one side in one individual) is without doubt a derived condition. The present genus shares no major characteristics with other New Zealand Notoaturins and I am uncertain of its relationships to the other genera.

63. Evidaturus exilis, new species

(Figs. 335, 337, 338, 340, 342, 576, 577)

Male: Integumental pigmentation absent, eye pigment reduced; dorsal shield $266\mu\text{m}$ in length, $243\mu\text{m}$ in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; the pair of glandularia which generally lie free in the integument (glandularia 2) have disappeared; postero-medial plate with two pairs of glandularia; ornamentation of dorsal shield similar to that shown for the female (figs. 576, 577); ventral shield $410\mu\text{m}$ in length, $297\mu\text{m}$ in width; anterior coxae projecting and bluntly pointed; capitular bay V-shaped but rounded posteriorly; glandularia of the fourth coxae located near suture lines between third and fourth coxae and well anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs truncate; a pair of glandularia (epimeroglandularia 2) located posteromedial to these projections; gonopore small, oval and subterminal; a few genital acetabula present on each side; excretory pore on a large terminal tubercle; figure 337 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, $15\mu\text{m}$; P-II, $43\mu\text{m}$; P-III, $22\mu\text{m}$; P-IV, $60\mu\text{m}$; P-V, $28\mu\text{m}$; structure of palp as illustrated for the female; capitulum $78\mu\text{m}$ in length; chelicera $93\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $62\mu\text{m}$; I-Leg-5, $70\mu\text{m}$; I-Leg-6, $64\mu\text{m}$; dorsal lengths of the segments of the fourth leg: IV-Leg-2, $76\mu\text{m}$; IV-Leg-3, $69\mu\text{m}$; IV-Leg-4, $72\mu\text{m}$; IV-Leg-5, $86\mu\text{m}$; IV-Leg-6, $79\mu\text{m}$; fourth leg unmodified (fig. 340).

Female: Dorsum as described for male; dorsal shield $315\mu\text{m}$ ($226\mu\text{m}$ - $338\mu\text{m}$) in length, $266\mu\text{m}$ ($243\mu\text{m}$ - $288\mu\text{m}$) in width; in one specimen, glandularia 2 is present on a small sclerite on one side (fig. 338); ventral shield $403\mu\text{m}$ ($380\mu\text{m}$ - $441\mu\text{m}$) in length, $282\mu\text{m}$ ($266\mu\text{m}$ - $293\mu\text{m}$) in width; except for genital field region, ventral shield as described for male; gonopore small for a female and subterminal; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$ ($15\mu\text{m}$ - $18\mu\text{m}$); P-II, $43\mu\text{m}$ ($45\mu\text{m}$ - $46\mu\text{m}$); P-III, $20\mu\text{m}$ ($19\mu\text{m}$ - $21\mu\text{m}$); P-IV, $59\mu\text{m}$ ($55\mu\text{m}$ - $56\mu\text{m}$); P-V, $29\mu\text{m}$ ($24\mu\text{m}$ - $29\mu\text{m}$); ventral side of P-IV bowed and with its ventral setae located in proximal half of segment (fig. 335); capitulum $79\mu\text{m}$ ($79\mu\text{m}$ - $85\mu\text{m}$) in length; chelicera $93\mu\text{m}$ ($90\mu\text{m}$ - $93\mu\text{m}$) in length; structure of capitulum and chelicera as illustrated for the related species (fig. 339); dorsal lengths of the distal segments of the first leg: I-Leg-4, $57\mu\text{m}$ ($50\mu\text{m}$ - $59\mu\text{m}$); I-Leg-5, $64\mu\text{m}$ ($55\mu\text{m}$ - $65\mu\text{m}$); I-Leg-6, $57\mu\text{m}$ ($48\mu\text{m}$ - $60\mu\text{m}$); structure of first leg much as shown for the related species (fig. 346); fourth leg similar to that illustrated for the male but heavy setae on IV-Leg-3 are not as thickened.

Holotype: Adult ♂, from a tributary of the Whangamoa River at Collins Valley Picnic Grounds, on Rt 6 just west of Rai Saddle, South Island, Nov. 22, 1982.

Allotype: Adult ♀, same area as holotype on Nov. 6, 1982.

Paratypes: SOUTH ISLAND: 2 ♀, from a tributary of the Wakamarina River 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 1 ♀, Four Mile River on Rt 6, between Charleston and Tiromoana, Nov. 8, 1982.

Discussion: See remarks under the following species for characteristics which will separate these two known members of the genus.

64. Evidaturus scoticus, new species

(Figs. 339, 341, 343, 344, 346-348)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield 258 μm in length, 243 μm in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; the glandularia typically lying free in the integument (glandularia 2) have disappeared completely; posteromedial plate bearing two pairs of glandularia; ornamentation of dorsal shield as shown for the related species (figs. 576, 577); ventral shield 380 μm in length, 266 μm in width; anterior coxae projecting far forward and relatively sharp-pointed; the capitular bay sharply V-shaped; glandularia of the fourth coxae placed very near suture line between third and fourth coxae and well anteromedial to insertions of fourth legs; projections associated with insertions of fourth legs truncate and relatively wide; a pair of glandularia (epimeroglandularia 2) placed posteromedial to these projections; gonopore very small, oval and subterminal; a few genital acetabula present on each side; excretory pore located on a moderately developed terminal tubercle; figure 348 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 15 μm ; P-II, 42 μm ; P-III, 19 μm ; P-IV, 46 μm ; P-V, 27 μm ; structure of palp as illustrated for female; capitulum 76 μm in length; chelicera 91 μm in length; figure 339 shows a lateral view of the capitulum and chelicera; dorsal lengths of the distal segments of the first leg: I-Leg-4, 50 μm ; I-Leg-5, 57 μm ; I-Leg-6, 52 μm ; dorsal lengths of the segments of the fourth leg: IV-Leg-2, 76 μm ; IV-Leg-3, 65 μm ; IV-Leg-4, 64 μm ; IV-Leg-5, 76 μm ; IV-Leg-6, 62 μm ; fourth leg relatively unmodified (fig. 347).

Female: Dorsum as described for male; dorsal shield 273 μm in length, 254 μm in width; ventral shield 403 μm in length, 273 μm in width; except for genital field area, ventral shield as described for male; gonopore small for a female, oval and subterminal (fig. 344); dorsal lengths of the palpal segments: P-I, 17 μm ; P-II, 40 μm ; P-III, 17 μm ; P-IV, 48 μm ; P-V, 27 μm ; P-IV bowed ventrally; one of the ventral setae of P-IV located near middle, the second is inserted in distal half of segment; figure 341 shows the proportions and chaetotaxy of the palp; capitulum 76 μm in length; chelicera 86 μm in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 52 μm ; I-Leg-5, 59 μm ; I-Leg-6, 52 μm ; figure 346 shows these segments; fourth leg similar to that of male.

Holotype: Adult σ , from gravel deposits in a stream on Wainui Rd, 5 km west of Mahinepua Rd, northern North Island, Oct. 22, 1982.

Allotype: Adult ρ , same data as holotype.

Discussion: The present species is closely related to the preceding species but has longer and more sharply pointed anterior coxae and the capitular bay is a sharp V-shape (compare figures 342 and 344). Also, the ventral bulge and ventral setae of P-IV are in the proximal half of segment in *exilis* (compare figures 335 and 341). Too few specimens are presently known to make any definitive statements concerning species ranges, but presently *scoticus* is known only from the very northern portion of North Island and *exilis* has only been taken on South Island.

Genus PIOTATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets with one pair of glandularia; a pair of glandularia sclerites (glandularia 2) between medial corners of anterolateral and posterolateral platelets and lateral edges of posteromedial plate; posteromedial plate bearing two pairs of glandularia; dorsal sclerites papillate and with noticeable ridges (figs. 578, 579); anterodorsal portion of ventral shield produced into a broad hood which is moderately projecting and indented medially in one species (fig. 350), scarcely projecting and slightly pointed in another (fig. 360); intercoxal slots well developed; projections associated with insertions of fourth legs more or less rounded; a pair of glandularia located well medial or anteromedial to insertions of fourth legs; posterior end of ventral shield and genital field highly modified in the male (fig. 350), with a large posterior cavity; males with a pronounced sexual dimorphism of the fourth leg (in the one species in which that sex is known); legs exhibiting some lateral compression but IV-Leg-3 relatively unmodified and IV-Leg-2 not especially enlarged; however, second segment of anterior legs is noticeably lengthened; capitulum with an anchoral process; P-II with ventral cuticular projections; P-IV bulging ventrally.

Type Species: *Piotaturus alvecaudatus*, new species

Discussion: The present genus seems most closely related to *Omegaturus*. It shares with this genus the intercoxal slots (fig. 349) and a similar development of a dorsal hood (at least in the type species), both of which seem to be apomorphic for the New Zealand notoaturins. The structure of the palp in *Piotaturus* is such that a simple lengthening of the palpal segments would produce the condition found in *Omegaturus*. IV-Leg-3 of the present genus is not modified as in the related genus but one can see a tendency in this direction in the third segment of the anterior three pairs of legs. Present evidence seems to indicate *Piotaturus* belongs on the evolutionary line which culminates in *Planaturus* and *Taintaturus*.

65. *Piotaturus alvecaudatus*, new species

(Figs. 345, 349-355, 358, 578)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $410\mu\text{m}$ ($418\mu\text{m}$ - $449\mu\text{m}$) in length, $441\mu\text{m}$ ($433\mu\text{m}$ - $471\mu\text{m}$) in width; anteromedial plate bearing the postocularia on small tubercles; anterolateral platelets with a pair of glandularia; a pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; anterior end of ventral shield produced into a wide, medially indented hood (fig. 350); ornamentation of dorsal shield as shown for the female (fig. 578); ventral shield $703\mu\text{m}$ ($692\mu\text{m}$ - $775\mu\text{m}$) in length, $502\mu\text{m}$ ($506\mu\text{m}$ - $540\mu\text{m}$) in width; anterior coxae are broad and somewhat pointed; glandularia of fourth coxae placed near the suture lines between third and fourth coxae; projections associated with insertions of fourth legs wide and rounded; posterior end of body highly modified; posterior suture lines of fourth coxae extending far anteromedially; epimeroglandularia 2 shifted well anteromedial to insertions of fourth legs; posterior end with a deep median cleft; gonopore hidden in ventral view by an anteriorly directed flap (fig. 353); many pairs of genital acetabula present; posterior end of ventral shield with an extremely large concavity; figures 349 and 350 indicate dorsal and ventral aspects of the ventral shield; excretory pore dorsal, slightly posterior to

posterior end of ventral shield; dorsal lengths of the palpal segments: P-I, 36 μm (35 μm -36 μm); P-II, 86 μm (86 μm -88 μm); P-III, 41 μm (40 μm -43 μm); P-IV, 87 μm (86 μm -93 μm); P-V, 62 μm (61 μm -62 μm); structure of palp as shown for the female; capitulum 152 μm (145 μm -154 μm) in length; chelicera 131 μm (121 μm -142 μm) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 72 μm (70 μm -76 μm); I-Leg-5, 96 μm (92 μm -97 μm); I-Leg-6, 92 μm (87 μm -93 μm); dorsal lengths of the segments of the fourth leg: IV-Leg-1, 111 μm (111 μm -118 μm); IV-Leg-2, 155 μm (141 μm -162 μm); IV-Leg-3, 118 μm (113 μm -133 μm); IV-Leg-4, 192 μm (178 μm -207 μm); IV-Leg-5 (to tip of distal projection) 296 μm (266 μm -311 μm); IV-Leg-6, 152 μm (155 μm -177 μm); greatest height of IV-Leg-5, 125 μm ; sexual dimorphism of fourth leg better illustrated (fig. 354) than described.

Female: Dorsum as described for male; dorsal shield 510 μm (532 μm -577 μm) in length, 460 μm (464 μm -516 μm) in width; dorsal shield proportionally longer, otherwise as described for male; figure 578 shows the ornamentation of the dorsal shield; ventral shield 668 μm (684 μm -744 μm) in length, 517 μm (517 μm -547 μm) in width; anterior coxae somewhat projecting; glandularia of the fourth coxae placed near suture lines between third and fourth coxae; median margins of fourth coxae reduced nearly to median angles; projections associated with insertions of fourth legs wide and relatively rounded; genital field region distinctly set off from remainder of body; gonopore subterminal and very large; several genital acetabula on each side; figure 358 shows the structure of the ventral shield; excretory pore dorsal in position; dorsal lengths of the palpal segments: P-I, 34 μm (34 μm -35 μm); P-II, 83 μm (81 μm -86 μm); P-III, 41 μm (40 μm -42 μm); P-IV, 83 μm (86 μm -90 μm); P-V, 62 μm (59 μm -61 μm); ventral side of P-II with several small sharp-pointed cuticular projections; figure 351 illustrates the structure of the palp; capitulum 145 μm (142 μm -162 μm) in length; chelicera 135 μm (128 μm -135 μm) in length; figure 355 shows the proportions of the capitulum and chelicera; dorsal lengths of the distal segments of the first leg: I-Leg-4, 69 μm (64 μm -69 μm); I-Leg-5, 83 μm (83 μm -86 μm); I-Leg-6, 79 μm (79 μm -83 μm); figure 352 shows these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, 128 μm (126 μm -144 μm); IV-Leg-5, 133 μm (129 μm -148 μm); IV-Leg-6, 103 μm (100 μm -111 μm); greatest height of IV-Leg-4, 81 μm (67 μm -73 μm); distal segments of fourth leg relatively high and somewhat laterally compressed.

Holotype: Adult σ , from a tributary of the Motupiko River on Rt 6, between Korere and Glenhope, South Island, Nov. 25, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: NORTH ISLAND: 1 f , stream at Sandy's Bridge on Rt 2, in the "Gorge" south of Opotiki, June 3, 1981; 1 f , tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 1 f , stream at Owihiritoa Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 1 σ , 1 f , stream at Sandy's Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 1 f , Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, Nov. 6, 1982; 2 σ , tributary of the Motupiko River, on Rt 6, between Korere and Glenhope, Nov. 7, 1982; 3 f , Graham Stream on Rt 6, at picnic grounds 8 km northeast of Whangamoia Saddle, Nov. 23, 1982; 3 σ , 1 f , same data as holotype.

Discussion: The sexual dimorphism of the male body and fourth leg is unique. See remarks under the following species for characters separating the females of these two species of *Piotaturus*.

66. Piotaturus bovalus, new species

(Figs. 356, 357, 359-361, 579)

Female: Both integumental and eye pigment absent; dorsal shield $456\mu\text{m}$ ($452\mu\text{m}$ - $471\mu\text{m}$) in length, $372\mu\text{m}$ ($365\mu\text{m}$ - $380\mu\text{m}$) in width; anterodorsal plate bearing the postocularia on small tubercles; anterolateral platelets with one pair of glandularia; a pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; no pronounced development of a hood on anterior end of ventral shield as in the related species; the ridges on dorsal shield indicated in figure 360 and also in figure 579, the latter also showing surface ornamentation; ventral shield $577\mu\text{m}$ ($577\mu\text{m}$ - $612\mu\text{m}$) in length, $388\mu\text{m}$ ($395\mu\text{m}$ - $422\mu\text{m}$) in width; anterior coxae broad and roundly pointed; glandularia of the fourth coxae located near suture lines between third and fourth coxae; projections associated with insertions of fourth legs wide and are rounded; genital field not distinctly set off from remainder of ventral shield; gonopore ventral; several genital acetabula present on each side; excretory pore located on a well developed terminal tubercle (fig. 361); dorsal lengths of the palpal segments: P-I, $28\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); P-II, $66\mu\text{m}$ ($64\mu\text{m}$ - $66\mu\text{m}$); P-III, $31\mu\text{m}$ ($31\mu\text{m}$ - $32\mu\text{m}$); P-IV, $81\mu\text{m}$ ($79\mu\text{m}$ - $85\mu\text{m}$); P-V, $41\mu\text{m}$ ($39\mu\text{m}$ - $41\mu\text{m}$); ventral side of P-II with well developed spine-like cuticular projections (fig. 359); capitulum $131\mu\text{m}$ ($128\mu\text{m}$ - $135\mu\text{m}$) in length; chelicera $121\mu\text{m}$ ($114\mu\text{m}$ - $121\mu\text{m}$) in length; structure of capitulum and chelicera similar to that shown for the related species (fig. 355); dorsal lengths of the distal segments of the first leg: I-Leg-4, $55\mu\text{m}$ ($52\mu\text{m}$ - $55\mu\text{m}$); I-Leg-5, $66\mu\text{m}$ ($66\mu\text{m}$ - $68\mu\text{m}$); I-Leg-6, $67\mu\text{m}$ ($64\mu\text{m}$ - $69\mu\text{m}$); figure 357 illustrates these segments; dorsal lengths of the distal segments of the fourth leg: IV-Leg-4, $93\mu\text{m}$ ($85\mu\text{m}$ - $91\mu\text{m}$); IV-Leg-5, $96\mu\text{m}$ ($89\mu\text{m}$ - $96\mu\text{m}$); IV-Leg-6, $81\mu\text{m}$ ($81\mu\text{m}$ - $89\mu\text{m}$); greatest height of IV-Leg-4, $41\mu\text{m}$ ($44\mu\text{m}$); these segments expanded (fig. 356) but not as much as in the previous species.

Male: Unknown.

Holotype: Adult ♀, Irongate Stream on Rt 1, 24 km north of Kaikoura, South Island, Nov. 21, 1982.

Paratypes: 6 ♀, same data as holotype.

Discussion: Unfortunately, the male of the present species is unknown but it is expected that it will show some degree of sexual dimorphism of the body and legs. Females of the present species differ from females of *alvecaudatus* in the ventral position of the gonopore, indistinct separation of the genital field region from rest of body and terminal position of excretory pore. The cuticular projections on the ventral side of P-II are also much longer in the present species.

Genus PARATRYSSATURUS Imamura

Paratryssaturus Imamura, 1979. Jour. Speleol. Soc. Japan, 4: 27.

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets with one pair of glandularia; a pair of glandularia (glandularia 2) located on small sclerites placed between medial corners of anterolateral and posterolateral platelets and lateral edges of posteromedian plate; posteromedian plate with two pairs of glandularia; glandularia not on tubercles; anterodorsal portion of the ventral shield with a long, somewhat pointed medial projection which extends

nearly as far forward as dorsal portion of camerostome (fig. 412); anterior three pairs of coxae projecting; coxae confined to anterior half of body; posterior margins of fourth coxae extending at right angles to long axis of body; glands of the fourth coxae placed near suture lines between third and fourth coxae; coxal slots absent; projections associated with insertions of fourth legs truncate and not bearing setae; genital field may be somewhat set off from remainder of ventral shield but no cauda present; gonopore ventral and well forward in both sexes; ventral papillae located on P-II, P-IV somewhat flattened ventrally and widened in a lateral to medial direction; IV-Leg-6 ending in a somewhat thickened seta on medial surface; males with a characteristic sexual dimorphism of the fourth leg in which IV-Leg-5 is expanded distally and bears three thickened setae; IV-Leg-4 also bears three thickened setae.

Type Species: *Paratryssaturus minutus* (Hopkins).

KEY TO THE NEW ZEALAND SPECIES OF PARATRYSSATURUS

1. Dorsal shield with conspicuous papillae (figs. 588, 590) 2
Dorsal shield without papillae (fig. 589)
Paratryssaturus zodelus, new species .. (p. 94)

2. Genital field area tending to be distinctly set off from remainder of ventral shield (figs. 409, 410); posteromedial plate and posterolateral platelets noticeably darker than the others; IV-Leg-5 of male expanding abruptly in distal half of segment (fig. 407)
Paratryssaturus cantermus, new species (p. 91)
Genital field area tending to be indistinctly set off from remainder of ventral shield (figs. 414, 416); integumental pigment completely absent; IV-Leg-5 of male gradually expanding, beginning in proximal half of segment (fig. 411)
Paratryssaturus minutus (Hopkins) (p. 93)

67. Paratryssaturus cantermus, new species

(Figs. 405, 407, 409, 410, 412, 413, 590)

Male: Integumental pigmentation present (posteromedial plate and posterolateral platelets darker) and eye pigment well developed; dorsal shield 327 μ m 319 μ m-342 μ m) in length, 243 μ m (212 μ m-247 μ m) in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; a pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield consisting of papillae joined into a reticulate background (fig. 590); ventral shield 440 μ m (440 μ m-456 μ m) in length, 251 μ m (232 μ m-258 μ m) in width; anterior coxae projecting; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs relatively wide and truncate; posterior suture lines of fourth coxae evident; genital field distinctly set off from rest of body; gonopore very small and ventral in position; several genital acetabula on each side near posterior end of ventral shield; excretory pore subterminal; figure 410 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 17 μ m (15 μ m-17 μ m); P-II, 38 μ m (36 μ m-39 μ m); P-III, 17 μ m (17 μ m-18 μ m); P-IV, 45 μ m (44 μ m-46 μ m); P-V, 24 μ m

(21 μ m-24 μ m); palp as shown for the female; capitulum 83 μ m (73 μ m-83 μ m) in length, chelicera 110 μ m (104 μ m-114 μ m) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 52 μ m (50 μ m-52 μ m); I-Leg-5, 54 μ m (50 μ m-56 μ m); I-Leg-6, 58 μ m (58 μ m-65 μ m); dorsal lengths of the segments of the fourth leg (measurements to distal end of distal projection on IV-Leg-2): IV-Leg-1, 58 μ m (55 μ m-57 μ m); IV-Leg-2, 83 μ m (81 μ m-83 μ m); IV-Leg-3, 52 μ m (52 μ m-55 μ m); IV-Leg-4, 64 μ m (62 μ m-66 μ m); IV-Leg-5, 63 μ m (65 μ m-66 μ m); IV-Leg-6, 48 μ m (48 μ m-50 μ m); projection of IV-Leg-2 sharp-pointed and projecting far beyond insertion of IV-Leg-3; proximal portion of IV-Leg-5 narrow for quite a distance before abruptly expanding (fig. 407).

Female: Morphology, color and ornamentation of dorsal shield as described for male; dorsal shield 319 μ m (315 μ m-349 μ m) in length, 243 μ m (232 μ m-273 μ m) in width; figure 590 shows the ornamentation of the dorsal shield; ventral shield 421 μ m (418 μ m-479 μ m) in length, 258 μ m (243 μ m-277 μ m) in width; female ventral shield proportionally wider but, except for genital field region, similar to that described for male; gonopore relatively small and located well anterior to posterior end; several pairs of acetabula near posterior end of genital field; excretory pore subterminal (fig. 409); dorsal lengths of the palpal segments: P-I, 16 μ m (15 μ m-18 μ m); P-II, 38 μ m (37 μ m-41 μ m); P-III, 16 μ m (16 μ m-17 μ m); P-IV, 45 μ m (43 μ m-46 μ m); P-V, 20 μ m (20 μ m-21 μ m); figure 405 shows the proportions and chaetotaxy of the palp; capitulum 83 μ m (83 μ m-88 μ m) in length; chelicera 112 μ m (110 μ m-114 μ m) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 45 μ m (44 μ m-50 μ m); I-Leg-5, 52 μ m (48 μ m-49 μ m); I-Leg-6, 55 μ m (52 μ m-58 μ m); figure 413 illustrates these segments; IV-Leg-2 with a projection which extends well beyond insertion of IV-Leg-3.

Holotype: Adult σ , from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglaen (Coromandel Peninsula), North Island, Oct. 27, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: NORTH ISLAND: 1 f , stream on Wainui Rd, 5 km west of Mahinepua Rd, Oct. 22, 1982; 3 σ , 4 f , same data as holotype; 1 σ , 1 f , Mangamawhete Stream on Rt 3, between Inglewood and Stratford (Egmont area), Nov. 1, 1982; 1 σ , Mangatokiiti Stream on Opunake Rd, 10 km west of Stratford (Egmont area), Nov. 1, 1982; 3 σ , 3 f , headwaters of Whangamata Stream, 10 km northwest of Taupo, Nov. 3, 1982; 1 f , Otupoto Stream on Rt 32, west of Lake Taupo, Nov. 3, 1982; SOUTH ISLAND: 2 σ , tributary of Wakamarina River 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 2 σ , 1 f , Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, Nov. 6, 1982; 1 f , tributary of Whangamoa River slightly west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 6, 1982; 2 f , Little Hope River on Rt 6, at bridge slightly southwest of the Hope Saddle (near Glenhope), Nov. 7, 1982; 4 σ , 7 f , Four Mile River on Rt 6, between Charleston and Tiromoana, Nov. 8, 1982; 2 σ , 1 f , Adamson Creek on Rt 6, between Lake Ianthe and Wanganui, Nov. 9, 1982; 1 f , Cole Creek on Rt 6, between Lake Moeraki and Haast, Nov. 10, 1982; 2 σ , 11 f , Shag River near its headwaters, on Rt 85, 2 km west of Pigroot Summit, Nov. 16, 1982; 5 σ , 3 f , small creek on Rt 6, approx 10 km west of Havelock (northern North Island), Nov. 22, 1982; 2 σ , 1 f , tributary of Whangamoa River on Rt 6, just west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 22, 1982; 2 σ , 1 f , Whangamoa River on Rt 6, approx 5 km northeast of Whangamoa Saddle, Nov. 23, 1982; 3 f , tributary of Waitapu River at Paynes Ford, 3 km south of Takaka, Nov. 24, 1982; 2 σ , 1 f , Pariwhakaoho River on Rt 60, 14 km northwest of Takaka, Nov. 24, 1982.

Discussion: The combination of pigmented posteromedial plate and postero-

lateral platelets, plus the subterminal position of the excretory pore and pronounced projection on IV-Leg-2, will separate both sexes of the present species from other members of the genus. The male fourth leg, with IV-Leg-5 narrow in much of the proximal portion and then abruptly widening, is also diagnostic.

68. Paratryssaturus minutus (Hopkins)

(Figs. 411, 414-418, 588)

Tryssaturus minutus Hopkins, 1969. Trans. Royal Soc. New Zealand, 11: 92.
Tryssaturus (Paratryssaturus) minutus Imamura, 1979. Jour. Speleol. Soc. Japan, 4: 28.

Male: Integumental pigment absent, eye pigment only slightly reduced; dorsal shield $384\mu\text{m}$ - $429\mu\text{m}$ in length, $228\mu\text{m}$ - $258\mu\text{m}$ in width; anteromedial plate bearing the postocularia; anterolateral platelets with one pair of glandularia; one pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield consisting of papillae joined into a reticulate pattern as shown for the female (fig. 588); ventral shield $384\mu\text{m}$ - $430\mu\text{m}$ in length, $228\mu\text{m}$ - $258\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs relatively wide and truncate; posterior suture lines of fourth coxae evident; genital field indistinctly set off from remainder of body; gonopore very small and ventral in position; several genital acetabula on each side near posterior end of genital field; excretory pore terminal; figure 414 shows the ventral shield; dorsal lengths of the palpal segments: P-I, $13\mu\text{m}$ - $14\mu\text{m}$; P-II, $34\mu\text{m}$ - $36\mu\text{m}$; P-III, $15\mu\text{m}$ - $17\mu\text{m}$; P-IV, $38\mu\text{m}$ - $45\mu\text{m}$; P-V, $19\mu\text{m}$ - $21\mu\text{m}$; palp as shown for female; capitulum $72\mu\text{m}$ - $76\mu\text{m}$ in length; chelicera $93\mu\text{m}$ - $104\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $43\mu\text{m}$ - $52\mu\text{m}$; I-Leg-5, $45\mu\text{m}$ - $52\mu\text{m}$; I-Leg-6, $52\mu\text{m}$ - $55\mu\text{m}$; dorsal lengths of the segments of the fourth leg: IV-Leg-1 $45\mu\text{m}$ - $55\mu\text{m}$; IV-Leg-2, $59\mu\text{m}$ - $69\mu\text{m}$; IV-Leg-3, $40\mu\text{m}$ - $48\mu\text{m}$; IV-Leg-4, $59\mu\text{m}$ - $65\mu\text{m}$; IV-Leg-5, $66\mu\text{m}$ - $76\mu\text{m}$; IV-Leg-6, $48\mu\text{m}$ - $55\mu\text{m}$; projection on IV-Leg-2 rather short and truncate; IV-Leg-5 gradually expanding along most of length; height of this segment approximately one-half its length (fig. 411).

Female: Dorsum as described for male; dorsal shield $304\mu\text{m}$ - $334\mu\text{m}$ in length, $243\mu\text{m}$ - $258\mu\text{m}$ in width; figure 588 shows the ornamentation of the dorsal shield; ventral shield $395\mu\text{m}$ - $440\mu\text{m}$ in length, $228\mu\text{m}$ - $258\mu\text{m}$ in width; female ventral shield similar to that of male except female gonopore is larger (fig. 416); dorsal lengths of the palpal segments: P-I, $15\mu\text{m}$ - $17\mu\text{m}$; P-II, $36\mu\text{m}$ - $42\mu\text{m}$; P-III, $14\mu\text{m}$ - $19\mu\text{m}$; P-IV, $41\mu\text{m}$ - $50\mu\text{m}$; P-V, $21\mu\text{m}$ - $27\mu\text{m}$; figure 415 shows the proportions and chaetotaxy of the palp; capitulum $79\mu\text{m}$ - $86\mu\text{m}$ in length; chelicera $104\mu\text{m}$ - $111\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $44\mu\text{m}$ - $50\mu\text{m}$; I-Leg-5, $48\mu\text{m}$ - $55\mu\text{m}$; I-Leg-6, $52\mu\text{m}$ - $64\mu\text{m}$; figure 417 shows these segments; IV-Leg-2 with a short projection as in male.

Material Examined: NORTH ISLAND: 1 ♂, Stream at Opato Bridge on Rt 2, in the "Gorge" south of Opotiki, June 3, 1981; 1 ♂, 3 ♀, Te Whaiiau Stream at the junction of Rt 47 and Rotoaria Rd, June 5, 1981; 4 ♂, 1 ♀, stream at Opato Bridge area, at rest stop on Rt 2 south of Opotiki, Oct. 29, 1982; 1 ♂, 1 ♀, stream at Sandy's Bridge on Rt 2, in "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 6 ♂, 3 ♀, tributary of Wakamarina River, 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 1 ♀, Adamson Creek on Rt 6, between Lake Ianthe and

Wanganui, Nov. 9, 1982; 2 ♂, 1 ♀, Potters Creek on Rt 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 1 ♀, Cole Creek on Rt 6, between Lake Moeraki and Haast, Nov. 10, 1982; 1 ♀, Dunton Creek on Rt 94, 85 km south of Milford Sound, Nov. 14, 1982; 1 ♂, 2 ♀, Oaro River at Oaro, on Rt 1, approx 20 km south of Kaikoura, Nov. 19, 1982; 1 ♂, Mororimu Stream on Rt 1, approx 35 km north of Kaikoura, Nov. 21, 1982; 3 ♂, 1 ♀, Kaituna River on Rt 6, 5 km south of Havelock, Nov. 22, 1982; 1 ♂, 2 ♀, Graham Stream on Rt 6 at picnic grounds, 8 km northeast of Whangamoia Saddle, Nov. 23, 1982; 2 ♂, from a tributary of Waitapu River at Paynes Ford, 3 km south of Takaka, Nov. 24, 1982; 4 ♂, 10 ♀, Parawhakaoho River on Rt 60, 14 km northwest of Takaka, Nov. 24, 1982.

Discussion: The combination of lack of integumental pigmentation, terminal excretory pore and characteristic dorsal ornamentation (fig. 588) is diagnostic for the present species. Imamura (1979) described a related species, *P. morimotoi*, from a cave stream near Nelson, South Island, stating it differed from *parvus* in having postocularia on the anteromedial plate and a more slender palp with projections on the ventral side of P-II. However, all notoaturins have the postocularia on the anteromedial plate and, depending on how the palp is rotated, the palp will appear thin or thick and the projections on the ventral side of P-II more or less obvious. Types of these two species should be checked for additional characters to separate them.

69. Paratryssaturus zodelus, new species

(Figs. 419-421, 424, 426, 589)

Male: Integumental pigment absent; dorsal shield $312\mu\text{m}$ in length, $243\mu\text{m}$ in width; anteromedial plate bearing the postocularia; anterolateral platelets with a pair of glandularia; one pair of glandularia on small sclerites lying free in the integument; posteromedial plate with two pairs of glandularia; ornamentation of the dorsal shield consisting of a reticulate pattern but lacking the characteristic papillae found in the other two species (fig. 589); ventral shield $410\mu\text{m}$ in length, $254\mu\text{m}$ in width; anterior coxae projecting; glands of the fourth coxae located near suture lines between third and fourth coxae; projections associated with the insertions of fourth legs relatively wide and truncate; posterior suture lines of fourth coxae evident; genital field indistinctly set off from remainder of body; gonopore very small and ventral in position; many acetabula present; excretory pore terminal; figure 419 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, $16\mu\text{m}$; P-II, $38\mu\text{m}$; P-III, $19\mu\text{m}$; P-IV, $48\mu\text{m}$; P-V, $24\mu\text{m}$; capitulum $72\mu\text{m}$ in length; chelicera $104\mu\text{m}$ in length; figure 424 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $52\mu\text{m}$; I-Leg-5, $54\mu\text{m}$; I-Leg-6, $65\mu\text{m}$; figure 420 shows these segments; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $48\mu\text{m}$; IV-Leg-2, $62\mu\text{m}$; IV-Leg-3, $45\mu\text{m}$; IV-Leg-4, $69\mu\text{m}$; IV-Leg-5, $72\mu\text{m}$; IV-Leg-6, $69\mu\text{m}$; projection on IV-Leg-2 short and very broad; IV-Leg-5 gradually expanding along most of length; length of this segment nearly three times its height (fig. 426).

Female: Not known with certainty, but two females taken from sand and gravel deposits in Staircase Creek where it flows into Lake Wakatipu (on Rt 6, southeast of Queenstown), South Island have the same surface ornamentation on the dorsal shield as is found in the male specimen from North Island. Until the male and female are taken in the same collection, the assignment of these two

females is tentative and they are not described here.

Holotype: Adult ♂, from Te Whaiiau Stream at junction of Rt 47 and Rotoaria Rd, North Island, June 5, 1981.

Discussion: The present species differs from the previous two species in its characteristic dorsal shield ornamentation (compare figure 589 with figures 588 and 590). Also the male IV-Leg-5 is the least expanded in *zodelus*.

Genus KRITATURUS, new genus

Diagnosis: Characters of the New Zealand Notoaturinae; anterolateral platelets bearing two pairs of glandularia; posteromedial plate with two pairs of glandularia; dorsal sclerites either smooth or with only a slight tendency to form reticulations or ridges, especially on the lateral platelets; first coxae narrow and projecting well beyond body proper; posterior suture lines of fourth coxae, if not obliterated, extending more or less at right angles to long axis of body; the glands of the fourth coxae located near suture lines between third and fourth coxae; projections associated with insertions of fourth legs well developed; coxal slots not developed; legs not laterally compressed; small ventral papillae may or may not be present on P-II; IV-Leg-1 not lengthened; male with or without a cauda; males of those species with a cauda also exhibiting a sexual dimorphism of the fourth leg.

Type Species: *Kritaturus gennadus*, new species.

Discussion: This genus seems very distantly related to the other New Zealand notoaturins and, with the exception of the evolutionary line with a well developed cauda (and extreme modification of the posteromedial plate), exhibiting few distinctive characteristics. Since we do not yet know what the ancestral notoaturin was like, it is impossible to be sure, but it seems likely that most of the characteristics used to define the genus will prove to be plesiomorphic. The one exception will likely be the fusion of glandularia 2 with the anteromedial platelets. A similar situation (two pairs of glandularia on the anterolateral platelets) is also found in *Planaturus*, but this is certainly a case of convergence.

The group of species in which the male exhibits a strong sexual dimorphism of the body and fourth legs is so distinctive that I was tempted to place it in a separate genus. However, females do not show characteristics which will allow them to be divided into separate genera. The two groups are, however, here split into subgenera based on presence or absence of sexual dimorphism.

Subgenus KRITATURUS: Includes those species in which a sexual dimorphism of the male body and legs is very slight or absent.

Subgenus CAUDATURUS, new subgenus: Includes those species in which the males possess a cauda, a pronounced modification of the posteromedial plate of the dorsal shield and the male fourth leg is modified.

Type Species: *Kritaturus (Caudaturus) tenomus*, new species.

KEY TO THE NEW ZEALAND SPECIES OF KRITATURUS

Of the nine species assigned to this genus, two are known only from the female and one only from the male. Also males of species exhibiting a strong sexual dimorphism of the body (subgenus *Caudaturus*) are best keyed out using these characteristics. For these reasons, separate keys are provided for the two sexes.

MALES

1. Body with a well developed cauda and a highly modified postero-medial plate (figs. 425, 433, 442, 452)... Subgenus Caudaturus 2
 Body without a well developed cauda and the posteromedial plate of the dorsal shield unmodified Subgenus Kritaturus 5
2. Palp uncate (fig. 453); IV-Leg-3 extending well beyond insertion of IV-Leg-4 and bearing a large, somewhat bifurcate seta (fig. 445)
Kritaturus uncipalpis, new species .. (p. 101)
 Palp not uncate; IV-Leg-3 extending slightly if at all beyond insertion of IV-Leg-4 3
3. Posterior end of cauda produced into an upturned projection which is best seen in lateral view (figs. 432, 440); paired concavities of posteromedial plate only slightly anterior to this projection; associated setae of the posterior glandularia of anterolateral platelets strongly curved (figs. 433, 442) 4
 Posterior end of cauda not upturned; paired concavities of posteromedial plate located much farther forward (fig. 425); setae of the posterior glandularia of the anterolateral platelets only slightly curved Kritaturus jacundus, new species ...(p. 97)
4. Cauda relatively wide (figs. 441, 442); setae of IV-Leg-3 greatly lengthened and thickened (fig. 444)
Kritaturus tenonus, new species ... (p. 99)
 Cauda much narrower (figs. 433, 434); setae of IV-Leg-3 only slightly lengthened and thickened (fig. 437)
Kritaturus rucabus, new species ...(p. 100)
5. Tips of first coxae broad; gonopore long and narrow (fig. 457); P-IV relatively wide and flattened ventrally, the medial edge appearing as a ridge in medial view (fig. 461); IV-Leg-1 through 4 with long dorsal setae (fig. 459)
Kritaturus sornus, new species(p. 102)
 Tips of first coxae more or less pointed; gonopore only slightly longer than wide; palp not flattened ventrally and without a medial ridge (fig. 472); none of the segments of the fourth leg with long dorsal setae 6
6. Gonopore more or less triangular, with rows of setae both anterior and lateral to the gonopore (fig. 480); posterior suture lines of fourth coxae absent Kritaturus dornarus, new species ..(p. 105)
 Gonopore oval, with a few setae anterolateral to opening (fig. 469); posterior suture lines of fourth coxae evident
Kritaturus gennadus, new species ..(p. 104)

FEMALES

1. Palp uncate, P-II with a ventral protubrance (fig. 453)
Kritaturus uncipalpis, new species . (p. 101)
 Palp not uncate, without a ventral protuberance on P-II 2

2. First coxae extending far forward and rounded at tips (figs. 436, 463); ventral side of P-IV somewhat flattened, with edge appearing as a ridge in medial view (figs. 438, 462); the two ventral setae of P-IV relatively far apart in a lateral to medial direction 3
 Tips of first coxae relatively sharp-pointed (figs. 467, 476, 481); ventral side of P-IV not flattened, edges not appearing as a ridge in medial view; the two ventral setae of P-IV relatively close together in a lateral to medial direction 6
3. Anterolateral platelets without ornamentation (figs. 591, 592) 4
 Anterolateral platelets exhibiting a somewhat reticulate ornamentation (figs. 593, 596) 5
4. Posteromedial plate of dorsal shield slightly longer than anteromedial plate (fig. 428) Kritaturus jacundus, new species ... (p. 97)
 Posteromedial plate noticeably shorter than anteromedial plate (fig. 435) Kritaturus tenonus, new species (p. 99)
5. Anteromedial plate of dorsal shield approximately same length as posteromedial plate (fig. 448); color of dorsum light and relatively uniform Kritaturus rucabus, new species ... (p. 100)
 Anteromedial plate of dorsal shield much shorter than posteromedial plate; anteromedial plate and anterolateral platelets a deep purple color, with other sclerites light (fig. 465)
Kritaturus ianthus, new species (p. 103)
6. Genital field distinctly set off from remainder of ventral shield; tips of first coxae sharp-pointed (fig. 467)
Kritaturus gennadus, new species .. (p. 104)
 Genital field not distinctly set off from remainder of ventral shield; tips of first coxae not as pointed (figs. 476, 481) 7
7. P-IV relatively short (fig. 479); integumental pigmentation is a reddish purple over entire dorsum
Kritaturus vinnulus, new species ... (p. 106)
 P-IV relatively long (fig. 475); integumental pigmentation consisting of a small purplish area on anteromedial plate and the remainder of dorsal shield is colorless
Kritaturus dornarus, new species .. (p. 105)

70. Kritaturus (Caudaturus) jacundus, new species

(Figs. 422, 423, 425, 427-431, 591, 606)

Male: Integumental and eye pigment well developed; dorsal shield $243\mu\text{m}$ ($228\mu\text{m}$ - $243\mu\text{m}$) in width; anteromedial plate large and bearing the postocularia; anterolateral platelets with two pairs of glandularia, the associated setae very long; posteromedial platelets reduced to small triangular sclerites; posteromedial plate highly modified, with the two pairs of glandularia difficult to see; an abruptly angled concavity present in anterior portion of posteromedial plate (indicated by stippled area in figure 425); a pair of large flap-like lobes extending posteromedially from edges of concavity, these best seen in lateral view

(fig. 431); central area posterior to concavity raised into a hump; other modifications of dorsal shield better illustrated (fig. 425) than described; ventral shield $380\mu\text{m}$ ($334\mu\text{m}$ - $365\mu\text{m}$) in length, $258\mu\text{m}$ ($236\mu\text{m}$ - $258\mu\text{m}$) in width; first coxae projecting; glands of the fourth coxae placed near suture lines between the third and fourth coxae; projections associated with insertions of fourth legs more or less rounded and directed posterolaterally; posterior end of ventral shield forming a well developed cauda bearing the genital field; gonopore somewhat triangular, much longer than wide and flanked anteriorly by an isolated pair of acetabula; a hyaline flap partially covering anterior portion of gonopore; a row of setae on each side anterior to gonopore; many acetabula present; lateral patches of setae present at base of cauda (figs. 423, 431); dorsal lengths of the palpal segments: P-I, $20\mu\text{m}$ ($17\mu\text{m}$ - $18\mu\text{m}$); P-II, $48\mu\text{m}$ ($43\mu\text{m}$ - $45\mu\text{m}$); P-III, $22\mu\text{m}$ ($20\mu\text{m}$ - $22\mu\text{m}$); P-IV, $58\mu\text{m}$ ($52\mu\text{m}$ - $55\mu\text{m}$); P-V, $25\mu\text{m}$ ($21\mu\text{m}$ - $24\mu\text{m}$); structure of palp similar to that of female; capitulum $86\mu\text{m}$ ($83\mu\text{m}$ - $86\mu\text{m}$) in length; chelicera $90\mu\text{m}$ ($93\mu\text{m}$ - $96\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $62\mu\text{m}$ ($55\mu\text{m}$ - $59\mu\text{m}$); I-Leg-5, $66\mu\text{m}$ ($62\mu\text{m}$ - $64\mu\text{m}$); I-Leg-6, $76\mu\text{m}$ ($69\mu\text{m}$ - $74\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-1, $60\mu\text{m}$ ($58\mu\text{m}$ - $65\mu\text{m}$); IV-Leg-2, $62\mu\text{m}$ ($55\mu\text{m}$ - $62\mu\text{m}$); IV-Leg-3, $67\mu\text{m}$ ($60\mu\text{m}$ - $65\mu\text{m}$); IV-Leg-4, $105\mu\text{m}$ ($93\mu\text{m}$ - $104\mu\text{m}$); IV-Leg-5, $114\mu\text{m}$ ($104\mu\text{m}$ - $107\mu\text{m}$); IV-Leg-6, $104\mu\text{m}$ ($97\mu\text{m}$ - $101\mu\text{m}$); some of the setae on IV-Leg-2, 3 and 4 modified, IV-Leg-4 slightly concave; structure of fourth leg better illustrated (fig. 430) than described.

Female: Integumental pigment and eye pigment developed; dorsal shield $342\mu\text{m}$ ($346\mu\text{m}$ - $357\mu\text{m}$) in length, $262\mu\text{m}$ ($266\mu\text{m}$ - $282\mu\text{m}$) in width; anteromedial plate approximately same length as posteromedial plate; dorsal sclerites without much ornamentation, although posterolateral platelets typically with longitudinal lines (fig. 591); ventral shield $365\mu\text{m}$ ($372\mu\text{m}$ - $380\mu\text{m}$) in length, $289\mu\text{m}$ ($304\mu\text{m}$ - $312\mu\text{m}$) in width; first coxae projecting well forward; glands of the fourth coxae near suture lines between third and fourth coxae; projections associated with insertions of fourth legs more or less rounded and directed posterolaterally; lateral ridges present in posterior portion of ventral shield (fig. 429); gonopore more or less terminal and flanked by many acetabula; dorsal lengths of the palpal segments: P-I, $20\mu\text{m}$ ($19\mu\text{m}$ - $21\mu\text{m}$); P-II, $52\mu\text{m}$ ($49\mu\text{m}$ - $51\mu\text{m}$); P-III, $21\mu\text{m}$ ($22\mu\text{m}$ - $23\mu\text{m}$); P-IV, $59\mu\text{m}$ ($56\mu\text{m}$ - $59\mu\text{m}$); P-V, $25\mu\text{m}$ ($26\mu\text{m}$ - $27\mu\text{m}$); ventral side of P-IV flattened, the medial edge of this flattened area appearing as a ridge in medial view (fig. 427); capitulum $86\mu\text{m}$ ($86\mu\text{m}$ - $90\mu\text{m}$) in length; chelicera $98\mu\text{m}$ ($98\mu\text{m}$ - $100\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $52\mu\text{m}$ ($52\mu\text{m}$ - $55\mu\text{m}$); I-Leg-5, $55\mu\text{m}$ ($57\mu\text{m}$ - $59\mu\text{m}$); I-Leg-6, $65\mu\text{m}$ ($65\mu\text{m}$ - $67\mu\text{m}$); figure 422 illustrates these segments.

Holotype: Adult ♂, Shag River near its headwaters on Rt 85, 2 km west of Pigroot Summit (Central Otago), South Island, Nov. 16, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: SOUTH ISLAND: 6 ♂, 56 ♀, same data as holotype; 1 ♂, 7 ♀, White Rock River (southwest of Timaru), where Cliffs Rd branches off Pareora Cave Rd, Nov. 18, 1982; 6 ♂, 32 ♀, Rocky Gully Stream on Rt 8, between Cave and Fairlie (west of Timaru), Nov. 18, 1982.

Discussion: The male has the longest but least modified cauda found in the four known species of the subgenus *Caudaturus*. The concavities of the posteromedial plate begin much farther anterior than in the other species and the associated hyaline flaps are much longer. These flaps are best seen in lateral view (fig. 431).

71. Kritaturus (Caudaturus) tenonus, new species

(Figs. 432-439, 592)

Male: Integumental and eye pigment developed; dorsal shield $282\mu\text{m}$ ($274\mu\text{m}$ - $288\mu\text{m}$) in width; anteromedial plate large and bearing the postocularia; anterolateral platelets with two pairs of glandularia and their associated setae very long; the most posterior of these setae recurved; posterolateral platelets somewhat reduced but not to the degree found in the previous species; posteromedial plate highly modified, with the two pairs of glandularia difficult to see; paired concavities present near posterior end of posteromedial plate; a pair of flap-like lobes extending posteromedially from edges of concavities, these best seen in lateral view (fig. 432); central area of posterior end of posteromedial plate raised into a hump which again is best seen in lateral view; other modifications of the dorsum better illustrated (fig. 433) than described; ventral shield $402\mu\text{m}$ ($410\mu\text{m}$ - $418\mu\text{m}$) in length, $304\mu\text{m}$ ($304\mu\text{m}$ - $319\mu\text{m}$) in width; first coxae projecting; glands of the fourth coxae near suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded and directed somewhat posterolaterally; posterior end of ventral shield forming a short but distinct cauda bearing the genital field; gonopore long but somewhat triangular; a hyaline flap partially covering anterior end of gonopore; a row of setae on each side near posterior end of gonopore; numerous genital acetabula; lateral patches of setae on dorsal portion of ventral shield dorsally at base of cauda (figs. 432, 433); dorsal lengths of the palpal segments: P-I, $23\mu\text{m}$ ($23\mu\text{m}$ - $25\mu\text{m}$); P-II, $57\mu\text{m}$ ($56\mu\text{m}$ - $62\mu\text{m}$); P-III, $26\mu\text{m}$ ($26\mu\text{m}$ - $30\mu\text{m}$); P-IV, $67\mu\text{m}$ ($65\mu\text{m}$ - $72\mu\text{m}$); P-V, $27\mu\text{m}$ ($28\mu\text{m}$ - $29\mu\text{m}$); structure of palp similar to that shown for female; capitulum $90\mu\text{m}$ ($93\mu\text{m}$ - $97\mu\text{m}$) in length; chelicera $110\mu\text{m}$ ($100\mu\text{m}$ - $114\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $68\mu\text{m}$ ($69\mu\text{m}$ - $72\mu\text{m}$); I-Leg-5, $73\mu\text{m}$ ($75\mu\text{m}$ - $77\mu\text{m}$); I-Leg-6, $85\mu\text{m}$ ($80\mu\text{m}$ - $86\mu\text{m}$); dorsal lengths of the segments of the fourth leg: IV-Leg-1, $79\mu\text{m}$ ($73\mu\text{m}$ - $83\mu\text{m}$); IV-Leg-2, $79\mu\text{m}$ ($73\mu\text{m}$ - $79\mu\text{m}$); IV-Leg-3, $83\mu\text{m}$ ($80\mu\text{m}$ - $86\mu\text{m}$); IV-Leg-4, $107\mu\text{m}$ ($109\mu\text{m}$ - $114\mu\text{m}$); IV-Leg-5, $112\mu\text{m}$ ($112\mu\text{m}$ - $118\mu\text{m}$); IV-Leg-6, $111\mu\text{m}$ ($104\mu\text{m}$ - $111\mu\text{m}$); fourth leg exhibiting sexual dimorphism, especially noticeable is the curved, thickened seta on the ventral side of IV-Leg-2 (fig. 437).

Female: Integumental and eye pigment developed; dorsal shield $426\mu\text{m}$ ($395\mu\text{m}$ - $426\mu\text{m}$) in length, $312\mu\text{m}$ ($302\mu\text{m}$ - $319\mu\text{m}$) in width; anteromedial plate much longer and wider than posteromedial plate; area where anterolateral platelets and posteromedial plate are in contact is relatively narrow; dorsal sclerites without much ornamentation (fig. 592); ventral shield $440\mu\text{m}$ ($420\mu\text{m}$ - $456\mu\text{m}$) in length, $334\mu\text{m}$ ($334\mu\text{m}$ - $350\mu\text{m}$) in width; first coxae projecting; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded and nearly covering the openings; gonopore more or less terminal and flanked by numerous acetabula (fig. 436); dorsal lengths of the palpal segments: P-I, $24\mu\text{m}$ ($22\mu\text{m}$ - $25\mu\text{m}$); P-II, $60\mu\text{m}$ ($58\mu\text{m}$ - $61\mu\text{m}$); P-III, $29\mu\text{m}$ ($27\mu\text{m}$ - $31\mu\text{m}$); P-IV, $70\mu\text{m}$ ($71\mu\text{m}$ - $76\mu\text{m}$); P-V, $29\mu\text{m}$ ($27\mu\text{m}$ - $29\mu\text{m}$); modification of P-IV as described for preceding species; figure 438 shows the proportions and chaetotaxy of the palp; capitulum $104\mu\text{m}$ ($96\mu\text{m}$ - $101\mu\text{m}$) in length; chelicera $114\mu\text{m}$ ($110\mu\text{m}$ - $117\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $60\mu\text{m}$ ($59\mu\text{m}$ - $63\mu\text{m}$); I-Leg-5, $69\mu\text{m}$ ($64\mu\text{m}$ - $70\mu\text{m}$); I-Leg-6, $78\mu\text{m}$ ($72\mu\text{m}$ - $76\mu\text{m}$); figure 439 illustrates these segments.

Holotype: Adult ♂, Pourakino River at Pourakino Picnic Grounds (in Longwood State Forest), on Harrington Rd south of Otautau, South Island, Nov. 13,

1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 1 ♂, 1 ♀, same data as holotype; 8 ♂, 13 ♀, from a stream on Rt 94, west of Mossburn, South Island, Nov. 13, 1982.

Discussion: The present species is most closely related to the following species. See remarks under the latter for characteristics distinguishing the males. The female of the present species may be easily recognized from all other known members of the genus by its very narrow area of contact between the anterolateral platelets and posteromedial plate (fig. 435).

72. Kritaturus (Caudaturus) rucabus, new species

(Figs. 440-444, 446-448, 593)

Male: Integumental and eye pigment well developed; dorsal shield $236\mu\text{m}$ in width; anteromedial plate very large and bearing the postocularia; anterolateral platelets with two pairs of glandularia, the associated setae long and the posterior pair noticeably curved; posterolateral platelets of moderate size and somewhat triangular; posteromedial plate highly modified, with the two pairs of glandularia difficult to see; a pair of abruptly angled concavities present in posterior half (indicated by stippled areas on figure 442); a pair of small flap-like lobes extending posteromedially over the concavities; central area of posteromedial plate posterior to concavities raised into a hump which is best seen in lateral view (fig. 440); other modifications of dorsal shield better shown (fig. 442) than described; ventral shield $342\mu\text{m}$ in length, $266\mu\text{m}$ in width; first coxae projecting far forward; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs more or less rounded and projecting posterolaterally; posterior end of ventral shield forming a short, wide cauda bearing the genital field; gonopore triangular and nearly terminal; many genital acetabula present; some setae posterior to gonopore are pectinate; prominent glandularia tubercles located at edges of body lateral to anterior end of gonopore; numerous setae in patches on posterodorsal portion of ventral shield, these best seen in lateral or dorsal views (figs. 440, 442); dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$; P-II, $54\mu\text{m}$; P-III, $26\mu\text{m}$; P-IV, $69\mu\text{m}$; P-V, $27\mu\text{m}$; ventral side of P-IV flattened, the medial edge appearing as a ridge (fig. 447); capitulum $93\mu\text{m}$ in length; chelicera $100\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $62\mu\text{m}$; I-Leg-5, $68\mu\text{m}$; I-Leg-6, $76\mu\text{m}$; figure 443 illustrates these segments; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $69\mu\text{m}$; IV-Leg-2, $67\mu\text{m}$; IV-Leg-3, $70\mu\text{m}$; IV-Leg-4, $114\mu\text{m}$; IV-Leg-5, $107\mu\text{m}$; IV-Leg-6, $105\mu\text{m}$; some of the setae on IV-Leg-2 and 3 lengthened, thickened and curved; the proportions and chaetotaxy of the fourth leg better illustrated (fig. 444) than described.

Female: Integumental and eye pigment well developed; dorsal shield $319\mu\text{m}$ ($319\mu\text{m}$ - $338\mu\text{m}$) in length, $270\mu\text{m}$ ($258\mu\text{m}$ - $266\mu\text{m}$) in width; anteromedial plate approximately same length as posteromedial plate; lateral platelets and anterior portion of anteromedial plate with a pattern of very small reticulations (fig. 593); ventral shield $380\mu\text{m}$ ($358\mu\text{m}$ - $380\mu\text{m}$) in length, $304\mu\text{m}$ ($274\mu\text{m}$ - $289\mu\text{m}$) in width; first coxae projecting far forward as in male; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with the insertions of fourth legs more or less rounded and projecting posterolaterally; gonopore subterminal and flanked by many acetabula; dorsal lengths of the palpal segments: P-I, $23\mu\text{m}$ ($22\mu\text{m}$ - $25\mu\text{m}$); P-II, $54\mu\text{m}$ ($48\mu\text{m}$ - $55\mu\text{m}$); P-III, $25\mu\text{m}$

(26 μ m-28 μ m); P-IV, 69 μ m (67 μ m); P-V, 28 μ m (26 μ m-27 μ m); structure of the palp as shown for male; capitulum 90 μ m in length; chelicera 107 μ m (104 μ m-107 μ m) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 56 μ m (55 μ m-59 μ m); I-Leg-5, 61 μ m (60 μ m-64 μ m); I-Leg-6, 67 μ m (66 μ m-72 μ m); first leg similar to that illustrated for the male.

Holotype: Adult σ , from Orauhora Stream on Rt 30, between Barryville and Bennydale, North Island, June 6, 1981.

Allotype (?): Adult f , Stream on Rt. 6 just north of Makatote Viaduct, between Raetiki and National Park, North Island, Nov. 2, 1982.

Paratypes (?): 2 f , same data as allotype.

Discussion: It is not certain that the male and females are conspecific. However, these mites possess first coxae that extend much farther forward than in any of the males and females of other known species. The male was newly metamorphosed and, therefore, a comparison of the dorsal shield ornamentation was impossible. However, these females were collected in central North Island less than 100 km from the type locality, well within the probable range of the species.

The male has the shortest and widest cauda of any known species of the subgenus. It is most closely related to *K. tenomus* but the latter has a narrower cauda and narrower gonopore (compare figures 434, 441) and the modifications of the setae on the fourth leg are more complex in the present species (compare figures 437, 444). Females of the two species are easily distinguished by the comparatively much larger anteromedial plate in *tenomus*.

73. Kritaturus (Caudaturus) uncipalpis, new species

(Figs. 445, 449-455, 594)

Male: Integumental and eye pigment well developed; dorsal shield 186 μ m (167 μ m-197 μ m) in width; anteromedial plate large, greatly narrowing posteriorly and bearing the postocularia; anterolateral platelets with two pairs of glandularia, the associated setae long and the posterior pair noticeably curved; posterolateral platelets reduced to small triangular sclerites; posteromedial plate highly modified with the two pairs of glandularia difficult to see; a pair of abruptly angled concavities present in posterior half (indicated by stippled area in figure 452); a pair of flap-like lobes extending posteromedially over the concavities; central area of posteromedial plate posterior to concavities raised into a hump which is best seen in lateral view (fig. 455); other modifications of the dorsal shield better illustrated (fig. 452) than described; ventral shield 308 μ m (296 μ m-319 μ m) in length, 209 μ m (186 μ m-224 μ m) in width; first coxae projecting, tips somewhat outhooked; glands of fourth coxae near suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded and projecting posterolaterally; posterior end of ventral shield forming a cauda bearing the genital field; gonopore triangular, surrounded on the three sides by setae, and is ventral in position; many genital acetabula present; numerous setae located in patches on posterodorsal portion of ventral shield (figs. 452, 455); dorsal lengths of the palpal segments: P-I, 18 μ m (19 μ m-21 μ m); P-II, 53 μ m (52 μ m-57 μ m); P-III, 31 μ m (30 μ m-37 μ m); P-IV, 52 μ m (49 μ m-57 μ m); P-V, 17 μ m (17 μ m-19 μ m); palp uncate and is as described and illustrated for the female; capitulum 71 μ m (66 μ m-72 μ m) in length; chelicera 74 μ m (69 μ m-79 μ m) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 50 μ m (48 μ m-52 μ m); I-Leg-5, 54 μ m (53 μ m-58 μ m); I-Leg-6, 63 μ m (62 μ m-72 μ m); dorsal lengths of the segments of the fourth leg: IV-Leg-1, 48 μ m (41 μ m-55 μ m); IV-Leg-2, 45 μ m

(43 μ m-48 μ m); IV-Leg-3 (to tip of distal projection), 72 μ m (59 μ m-72 μ m); IV-Leg-4, 62 μ m (63 μ m-72 μ m); IV-Leg-5, 73 μ m (76 μ m-83 μ m); IV-Leg-6, 76 μ m (78 μ m-89 μ m); IV-Leg-3 projecting far beyond insertion of IV-Leg-4 and this projection bearing a heavy, bifurcate seta; with rare exceptions, the legs in preserved specimens are in the position indicated in figure 445, which means this is the extended position.

Female: Integumental and eye pigment well developed; dorsal shield 273 μ m (247 μ m-273 μ m) in length, 186 μ m (182 μ m-190 μ m) in width; anteromedial plate slightly shorter than posteromedial plate; lateral platelets and anterior portion of anteromedial plate with a pattern of small reticulations (fig. 594); anterolateral platelets with two pairs of glandularia; the posteromedial plate with two pairs of glandularia; ventral shield 308 μ m (289 μ m-319 μ m) in length, 206 μ m (194 μ m-217 μ m) in width; first coxae projecting; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded and projecting posterolaterally; gonopore subterminal and flanked by many acetabula; dorsal lengths of the palpal segments: P-I, 20 μ m (18 μ m-22 μ m); P-II, 51 μ m (50 μ m-52 μ m); P-III, 31 μ m (31 μ m-36 μ m); P-IV, 52 μ m (50 μ m-54 μ m); P-V, 17 μ m (16 μ m-19 μ m); P-II with a ventral bump; distoventral portion of P-IV produced to form an uncate palp (fig. 453); capitulum 72 μ m (69 μ m-72 μ m) in length; chelicera 76 μ m (79 μ m) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 41 μ m (40 μ m-45 μ m); I-Leg-5, 45 μ m (44 μ m-47 μ m); I-Leg-6, 59 μ m (52 μ m-59 μ m); figure 449 illustrates these segments.

Holotype: Adult σ , from a small cascade in a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), North Island, Oct. 27, 1982.

Allotype: Adult ρ , same data as holotype.

Paratypes: NORTH ISLAND: 1 σ , same data as holotype except mite taken in the tributary stream; 7 σ , 32 ρ , same data as holotype; 1 σ , Otupoto Stream on Rt 32, west of Lake Taupo, Nov. 3, 1982; SOUTH ISLAND: 1 ρ , Whale Creek on Rt 6, west of Murchison, Nov. 7, 1982; 2 σ , 2 ρ , Hope River on Rt 6, between Glenhope and Kawatiri, Nov. 25, 1982.

Discussion: The most striking characteristic of this species is the uncate palp, an obviously autapomorphic condition. Other members of the subgenus have an enlarged distoventral setal tubercle on P-IV (fig. 447) and it seems very likely the uncate condition has resulted from a much greater expansion of this tubercle. The sexual dimorphism of the male fourth leg, with IV-Leg-3 possessing a long distal projection bearing a heavy bifurcate seta, is strikingly different from other members of the subgenus.

74. Kritaturus (Kritaturus) sornus, new species

(Figs. 456-461, 595)

Male: Integumental and eye pigment present; dorsal shield 342 μ m (327 μ m) in length, 304 μ m (312 μ m) in width; anteromedial plate bearing the postocularia; anterolateral platelets with two pairs of glandularia; posteromedial plate with two pairs of glandularia; posteromedial plate nearly square, but slightly wider than long; figure 595 indicates the dorsal ornamentation; ventral shield 388 μ m (365 μ m) in length, 319 μ m (327 μ m) in width; first coxae relatively broad, projecting and round at tips; glands of the fourth coxae located near suture lines between third and fourth coxae; projections associated with insertions of fourth legs

roundly pointed and projecting posteriorly; genital field indistinctly set off from remainder of ventral shield; gonopore long and narrow, and nearly terminal; the genital acetabula numerous; these divided into dorsal and ventral groupings by an area of this integument which can be seen in posterior view (fig. 456); figure 457 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $25\mu\text{m}$ ($23\mu\text{m}$); P-II, $55\mu\text{m}$ ($52\mu\text{m}$); P-III, $29\mu\text{m}$ ($26\mu\text{m}$); P-IV, $66\mu\text{m}$ ($62\mu\text{m}$); P-V, $26\mu\text{m}$ ($24\mu\text{m}$); ventral side of P-II with several small tubercles; P-IV flattened ventrally and the medial edge of this flattened area appearing as a longitudinal ridge in medial view; the two ventral setae of P-IV relatively far apart in a lateral to medial direction; figure 461 shows the structure of the palp; capitulum $90\mu\text{m}$ ($87\mu\text{m}$) in length; chelicera $100\mu\text{m}$ ($96\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $60\mu\text{m}$; I-Leg-5, $69\mu\text{m}$ ($67\mu\text{m}$); I-Leg-6, $72\mu\text{m}$ ($69\mu\text{m}$); figure 460 illustrates these segments; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $79\mu\text{m}$ ($76\mu\text{m}$); IV-Leg-2, $59\mu\text{m}$ ($58\mu\text{m}$); IV-Leg-3, $67\mu\text{m}$ ($69\mu\text{m}$); IV-Leg-4, $80\mu\text{m}$ ($79\mu\text{m}$); IV-Leg-5, $93\mu\text{m}$ ($96\mu\text{m}$); IV-Leg-6, $86\mu\text{m}$ ($84\mu\text{m}$); dorsal side of IV-Leg-1 through 4 with long setae; figure 459 shows the proportions and chaetotaxy of the fourth leg.

Female: Unknown.

Holotype: Adult ♂, Pourakino River at Pourakino Picnic Grounds (in Longwood State Forest), on Harrington Rd south of Otautau, South Island, Nov. 31, 1982.

Paratype: 1 ♂, same data as holotype.

Discussion: The palp, with its longitudinal ridge on P-IV and tubercles on P-II, is much more like that found in members of the subgenus *Caudaturus*. However, the present species lacks both the sexual dimorphism of the male body and fourth leg characteristic of that subgenus.

75. Kritaturus (?Kritaturus) ianthus, new species

(Figs. 462-465, 596)

Female: Integumental and eye pigment well developed; dorsal shield $349\mu\text{m}$ ($304\mu\text{m}$ - $349\mu\text{m}$) in length, $266\mu\text{m}$ ($228\mu\text{m}$ - $258\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with two pairs of glandularia; posteromedial plate with two pairs of glandularia; anteromedial plate and the anterolateral platelets colored a deep purple, other dorsal sclerites light colored; posteromedial plate noticeably longer than the anteromedial plate; figure 596 shows the ornamentation of the dorsal shield; ventral shield $403\mu\text{m}$ ($365\mu\text{m}$ - $395\mu\text{m}$) in length, $278\mu\text{m}$ ($243\mu\text{m}$ - $278\mu\text{m}$) in width; first coxae projecting, with tips more or less rounded; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded and directed posterolaterally; gonopore more or less terminal; with many acetabula in three or four rows along posterior margin (fig. 463); dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$ ($19\mu\text{m}$ - $22\mu\text{m}$); P-II, $55\mu\text{m}$ ($49\mu\text{m}$ - $56\mu\text{m}$); P-III, $24\mu\text{m}$ ($24\mu\text{m}$ - $26\mu\text{m}$); P-IV, $72\mu\text{m}$ ($68\mu\text{m}$ - $76\mu\text{m}$); P-V, $38\mu\text{m}$ ($36\mu\text{m}$ - $38\mu\text{m}$); ventral side of P-II with several small papillae; P-IV flattened ventrally and the medial edge of this flattened area appearing as a longitudinal ridge in medial view; the two ventral setae of P-IV far apart in a lateral to medial direction; figure 462 shows the proportions and chaetotaxy of the palp; capitulum $93\mu\text{m}$ ($86\mu\text{m}$ - $98\mu\text{m}$) in length; chelicera $100\mu\text{m}$ ($100\mu\text{m}$ - $104\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $52\mu\text{m}$ (45

μm -50 μm); I-Leg-5, 61 μm (57 μm -62 μm); I-Leg-6, 72 μm (69 μm -72 μm); figure 464 illustrates these segments.

Male: Unknown.

Holotype: Adult ♀, Pourakino River at Pourakino Picnic Grounds (in Longwood State Forest) on Harrington Rd south of Otautau, South Island, Nov. 13, 1982.

Paratypes: NORTH ISLAND: 1 ♀, Kareara Stream, 14 km east of turnoff (Rt 5) to Taupo, June 4, 1981; 2 ♀, river at Broadwood in northern North Island, Oct. 21, 1982; 1 ♀, tributary of Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; 1 ♀, Orauhora Stream on Rt 30, between Barryville and Benneydale, Oct. 31, 1982; 1 ♀, Mangamawhete Stream on Rt 3, between Inglewood and Stratford (Egmont area), Nov. 1, 1982; SOUTH ISLAND: Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, Nov. 6, 1982; 2 ♀, Hope River on Rt 6, between Glenhope and Kawatiri, Nov. 25, 1982.

Discussion: The color pattern, with the very dark anteromedial plate and anterolateral platelets contrasting with the lightly colored other sclerites of the dorsum is diagnostic. The palpal structure and morphology of the first coxae are similar to that found both in the previous species and members of the subgenus *Caudaturus*. Therefore, until the male is known, subgeneric placement is uncertain. It is surprising that a male was not taken for, although this species was never common in any one collection, it was taken in eight widely scattered localities on both islands, and was collected in June, October and November.

76. Kritaturus (Kritaturus) gennadus, new species

(Figs. 466-470, 472, 597)

Male: Integumental and eye pigment well developed; dorsal shield 293 μm (282 μm) in length, 221 μm (213 μm) in width; anteromedial plate bearing the post-ocularia; anterolateral platelets with two pairs of glandularia; posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield as shown for the female (fig. 597); ventral shield 354 μm (338 μm) in length, 232 μm (235 μm) in width; first coxae projecting far forward and sharp-pointed; glands of the fourth coxae located near suture lines between third and fourth coxae; projections associated with insertions of fourth legs roundly pointed and directed more or less posteriorly; posterior suture lines of fourth coxae well developed, extending to midline and continuing forward as a medial suture line (fig. 469); genital field distinctly set off from remainder of ventral shield; gonopore small, oval, subterminal and flanked by two pairs of setae; genital acetabula numerous; dorsal lengths of the palpal segments: P-I, 21 μm (20 μm); P-II, 59 μm (54 μm); P-III, 25 μm (26 μm); P-IV, 104 μm (97 μm); P-V, 35 μm (34 μm); structure of the palp as described and illustrated for the female; capitulum 100 μm (97 μm) in length; chelicera 97 μm (90 μm) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 52 μm (48 μm); I-Leg-5, 62 μm (56 μm); I-Leg-6, 67 μm (62 μm); dorsal lengths of the segments of the fourth leg: IV-Leg-1, 48 μm (45 μm); IV-Leg-2, 45 μm (44 μm); IV-Leg-3, 45 μm (47 μm); IV-Leg-4, 53 μm (55 μm); IV-Leg-5, 67 μm (65 μm); IV-Leg-6, 69 μm (72 μm); fourth leg relatively unmodified, its structure better illustrated (fig. 466) than described.

Female: Integumental and eye pigment well developed; dorsal shield 308 μm (334 μm) in length, 243 μm (258 μm) in width; dorsal shield as described for the

male; figure 597 shows the ornamentation of the dorsal shield; ventral shield $373\mu\text{m}$ ($395\mu\text{m}$) in length, $273\mu\text{m}$ ($281\mu\text{m}$) in width; coxal region as described for the male except posterior and medial suture lines of fourth coxae are not developed; genital field distinctly set off from rest of ventral shield; gonopore of moderate size and nearly terminal; genital acetabula numerous; dorsal lengths of the palpal segments: P-I, $22\mu\text{m}$ ($21\mu\text{m}$); P-II, $52\mu\text{m}$; P-III, $29\mu\text{m}$ ($27\mu\text{m}$); P-IV, $113\mu\text{m}$ ($98\mu\text{m}$); P-V, $34\mu\text{m}$; P-IV without a medial ridge, ventral setae of P-IV relatively close together in a lateral to medial direction; no tubercles on ventral side of P-II; figure 472 illustrates the proportions and chaetotaxy of the palp; capitulum $104\mu\text{m}$ ($100\mu\text{m}$) in length; chelicera $93\mu\text{m}$ ($100\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $48\mu\text{m}$; I-Leg-5, $58\mu\text{m}$ ($60\mu\text{m}$); I-Leg-6, $69\mu\text{m}$; figure 470 illustrates these segments.

Holotype: Adult σ , Four Mile River on Rt 6, between Charleston and Tiro-moana, South Island, Nov. 8, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: 1 σ , 1 f , Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, South Island, Nov. 6, 1982.

Discussion: The present species is the type for the subgenus. The following two species and it are more typical members of the subgenus. They are characterized by a palp without papillae on P-II and no ridge on P-IV (i.e., ventral side of P-IV is not flattened), and the ventral setae on P-IV are relatively close together in a lateral to medial direction. Also, the tips of the first coxae are more or less sharp-pointed. The present species is easily distinguished by the very sharp-pointed tips of the first coxae and by their possession of a genital field distinctly set off from remainder of ventral shield. The well developed medial and posterior suture lines of the male fourth coxae are also diagnostic for that sex.

77. Kritaturus (Kritaturus) dornarus, new species

(Figs. 471, 473-475, 480, 481, 598)

Male: Integumental and eye pigment well developed; dorsal shield $247\mu\text{m}$ in length, $213\mu\text{m}$ in width; anteromedial plate bearing the postocularia; anterolateral platelets with two pairs of glandularia; posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield as shown for the female (fig. 598); ventral shield $327\mu\text{m}$ in length, $236\mu\text{m}$ in width; first coxae projecting and are somewhat pointed; glands of the fourth coxae located near suture lines between third and fourth coxae; projections associated with insertions of fourth legs are roundly pointed and directed more or less posteriorly; posterior suture lines of fourth coxae poorly developed; genital field not set off from remainder of ventral shield; gonopore small, somewhat triangular, and surrounded on three sides by setae (fig. 480); genital acetabula numerous; dorsal lengths of the palpal segments: P-I, $21\mu\text{m}$; P-II, $59\mu\text{m}$; P-III, $27\mu\text{m}$; P-IV, $107\mu\text{m}$; P-V, $40\mu\text{m}$; capitulum $89\mu\text{m}$ in length; chelicera $96\mu\text{m}$ in length; structure of mouthparts as shown for the female; dorsal lengths of the distal segments of the first leg: I-Leg-4, $62\mu\text{m}$; I-Leg-5, $76\mu\text{m}$; I-Leg-6, $86\mu\text{m}$; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $57\mu\text{m}$; IV-Leg-2, $46\mu\text{m}$; IV-Leg-3, $55\mu\text{m}$; IV-Leg-4, $69\mu\text{m}$; IV-Leg-5, $81\mu\text{m}$; IV-Leg-6, $79\mu\text{m}$; fourth leg relatively unmodified, its structure better illustrated (fig. 473) than described.

Female: Integumental and eye pigment well developed; dorsal shield $304\mu\text{m}$ in length, $212\mu\text{m}$ in width; dorsal shield as described for the male; figure 598

shows the ornamentation of the dorsal shield; ventral shield $349\mu\text{m}$ in length, $243\mu\text{m}$ in width; ventral shield, except for genital field region, as described for male; gonopore nearly terminal and flanked by numerous genital acetabula; genital field area not set off from remainder of ventral shield; figure 481 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $22\mu\text{m}$; P-II, $59\mu\text{m}$; P-III, $28\mu\text{m}$; P-IV, $99\mu\text{m}$; P-V, $41\mu\text{m}$; P-IV without a medial ridge, ventral setae of P-IV close together in a lateral to medial direction; no tubercles on the ventral side of P-II; capitulum $87\mu\text{m}$ in length; chelicera $96\mu\text{m}$ in length; figure 475 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $52\mu\text{m}$; I-Leg-5, $59\mu\text{m}$; I-Leg-6, $69\mu\text{m}$; figure 474 shows these segments.

Holotype: Adult ♂, from a small cascade in a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), North Island, Oct. 27, 1982.

Allotype: Adult ♀, same data as holotype.

Discussion: The combination of no sexual dimorphism of the body or legs and triangular gonopore are diagnostic for the male. Characters given in the key will distinguish the female.

78. Kritaturus (Kritaturus) vinnulus, new species

(Figs. 476-479, 599)

Female: Integumental and eye pigment developed; dorsal shield $319\mu\text{m}$ ($319\mu\text{m}$) in length, $243\mu\text{m}$ ($251\mu\text{m}$) in width; anteromedial plate bearing the postocularia; anterolateral platelets with two pairs of glandularia; Posteromedial plate with two pairs of glandularia; ornamentation of dorsal shield shown in figure 599; ventral shield $354\mu\text{m}$ ($365\mu\text{m}$) in length, $243\mu\text{m}$ ($258\mu\text{m}$) in width; anterior coxae projecting and somewhat pointed; glands of the fourth coxae located noticeably posterior to suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded and projecting more or less posteriorly; posterior suture lines of fourth coxae obliterated; genital field not set off from the remainder of the ventral shield; gonopore somewhat subterminal and flanked by numerous acetabula; figure 476 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $18\mu\text{m}$ ($22\mu\text{m}$); P-II, $51\mu\text{m}$ ($52\mu\text{m}$); P-III, $24\mu\text{m}$ ($26\mu\text{m}$); P-IV, $76\mu\text{m}$ ($79\mu\text{m}$); P-V, $41\mu\text{m}$ ($38\mu\text{m}$); P-IV without a median ridge, ventral setae on P-IV close together in a lateral to medial direction; P-II without ventral tubercles; figure 479 shows the proportions and chaetotaxy of the palp; capitulum $86\mu\text{m}$ ($85\mu\text{m}$) in length; chelicera $98\mu\text{m}$ ($104\mu\text{m}$) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $46\mu\text{m}$ ($49\mu\text{m}$); I-Leg-5, $52\mu\text{m}$ ($55\mu\text{m}$); I-Leg-6, $69\mu\text{m}$ ($69\mu\text{m}$); figure 477 shows these segments.

Male: Unknown:

Holotype: Adult ♀, Shag River near its headwaters, on Rt 85, 2 km west of Pigroot Summit (Central Otago), South Island, Nov. 16, 1982.

Paratype: 1 ♀, Pourakino River at Pourakino Picnic Grounds (in Longwood State Forest), on Harrington Rd south of Otautau, South Island, Nov. 13, 1982.

Discussion: The present species, based on the female only, seems most closely related to the previous species, *K. dornarus*, but the latter has a proportionally much longer P-IV (compare figures 475, 479) and there is a difference in the color pattern of the dorsal shield which is described as a part of the key to species.

Genus URALBIA Hopkins

Uralbia Hopkins, 1967. Trans. Royal Soc. New Zealand, 10: 44.

Diagnosis: Characters of the New Zealand Notoaturinae; anteromedial plate bearing widely spaced postocularia; anterolateral platelets with one pair of glandularia with long associated setae; posterolateral platelets with a pair of long setae which are the homologs of glandularia (gland portion has disappeared); the posteromedial plate with two pairs of setae which are the homologs of glandularia; excretory pore lying on the posteromedial plate in the female; dorsum without ornamentation (fig. 600); coxae projecting far forward and pointed; no intercoxal slots present; capitular bay long and comparatively narrow; suture lines of fourth coxae apparent for only a short distance medial to insertions of fourth legs; projections associated with insertions of fourth legs large and rounded; glands of the fourth coxae near suture lines between third and fourth coxae; many genital acetabula present; female gonopore large and terminal (fig. 482); male genital field with paired acetabula-bearing lobes extending posterior to gonopore (fig. 484); palpal segments elongated, P-II with spine-like cuticular projections on ventral side (fig. 492); male fourth leg exhibiting a sexual dimorphism in the proportions of the segments and in the setae of IV-Leg-3 and 4.

Type Species: *Uralbia projecta* Hopkins.

Discussion: This genus is so distinctive it needs no further characterization. One interesting aspect of the genus is that it provides another example of an interstitial group in which the gland portion of the glandularia has disappeared. This obliteration of the glands has occurred independently in several completely unrelated families from the hyporheic habitat, but I know of only one example of its occurrence in a species living in superficial waters. That example is the New Zealand species *Aciculacarus papillosus* Hopkins, in which two of the dorsal glandularia pairs have lost the gland portion.

79. *Uralbia gracilipes*, new species

(Figs. 482-487, 492, 600)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $349\mu\text{m}$ ($349\mu\text{m}$ - $380\mu\text{m}$) in length, $308\mu\text{m}$ ($318\mu\text{m}$ - $327\mu\text{m}$) in width; anteromedial plate bearing laterally placed postocularia; anterolateral platelets with one pair of glandularia, the associated setae long; posterolateral platelets with the homologs of a pair of glandularia, but the gland portion has disappeared, leaving only the associated setae; posteromedial plate with the homologs of two pairs of glandularia, but here also the gland portion has disappeared, leaving only the setae to mark the locations (fig. 486); excretory pore placed on dorsal portion of ventral shield; ventral shield $608\mu\text{m}$ ($597\mu\text{m}$ - $646\mu\text{m}$) in length, $334\mu\text{m}$ ($341\mu\text{m}$ - $360\mu\text{m}$) in width; coxae projecting far forward and pointed; capitular bay very long and narrow; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded; posterior suture lines of fourth coxae evident for only a short distance medial to insertions of fourth legs; genital field projecting beyond body; genital field consisting of paired posteriorly directed lobes bearing the acetabula; gonopore small but gradually widening posteriorly when viewed ventrally; end of ventral shield with a bluntly pointed projection bearing a ventral keel; genital field area better illustrated (fig. 484) than described; dorsal lengths of the palpal segments: P-I,

74 μ m (71 μ m-74 μ m); P-II, 121 μ m (119 μ m-128 μ m); P-III, 106 μ m (102 μ m-114 μ m); P-IV, 276 μ m (266 μ m-310 μ m); P-V, 34 μ m (33 μ m-35 μ m); palp as described for the female; capitulum 162 μ m (157 μ m-173 μ m) in length; chelicera 134 μ m (128 μ m-131 μ m) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 100 μ m (90 μ m-104 μ m); I-Leg-5, 135 μ m (121 μ m-138 μ m); I-Leg-6, 131 μ m (134 μ m-145 μ m); dorsal lengths of the segments of the fourth leg: IV-Leg-1, 133 μ m (133 μ m-140 μ m); IV-Leg-2, 199 μ m (165 μ m-192 μ m); IV-Leg-3, 140 μ m (129 μ m-140 μ m); IV-Leg-4, 192 μ m (177 μ m-207 μ m); IV-Leg-5, 273 μ m (236 μ m-273 μ m); IV-Leg-6, 200 μ m (178 μ m-192 μ m); segments of fourth leg relatively narrow; medial surface of IV-Leg-3 and 4 with numerous, somewhat thickened setae, these better illustrated (fig. 483) than described; setae on IV-Leg-3 somewhat foreshortened in the illustration.

Female: Integumental pigment absent, eye pigment reduced; dorsal shield 440 μ m (388 μ m-420 μ m) in length, 319 μ m (289 μ m-334 μ m) in width; structure of dorsal shield as described for the male but posteromedial plate is proportionally much longer and bears the excretory pore (compare figures 485, 486); figure 600 is a photograph of the dorsal shield; ventral shield 638 μ m (593 μ m-646 μ m) in length, 349 μ m (320 μ m-364 μ m) in width; anterior portion of ventral shield as described for male; distance from fourth coxae to posterior end of ventral shield much greater than in male; gonopore terminal and relatively large; many acetabula present, most of which are terminal in position (fig. 482); dorsal lengths of the palpal segments: P-I, 72 μ m (70 μ m-72 μ m); P-II, 121 μ m (117 μ m-124 μ m); P-III, 107 μ m (104 μ m); P-IV, 266 μ m (259 μ m-270 μ m); P-V, 35 μ m; P-II with several long, pointed cuticular projections on proximal portion of ventral side; figure 492 shows the proportions and chaetotaxy of the palp; capitulum 169 μ m (157 μ m-166 μ m) in length; chelicera 134 μ m (124 μ m-130 μ m) in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 86 μ m (80 μ m-90 μ m); I-Leg-5, 117 μ m (104 μ m-118 μ m); I-Leg-6, 117 μ m (114 μ m-121 μ m); figure 487 illustrates these segments.

Holotype: Adult σ , Kaituna River on Rt 6, 5 km south of Havelock, northern South Island, Nov. 22, 1982.

Allotype: Adult f , same data as holotype.

Paratypes: SOUTH ISLAND: 1 σ , 3 f , tributary of Wakamarina River, 7 km southeast of Canvastown (off Rt 6), Nov. 5, 1982; 1 f , tributary of Whangamoa River on Rt 6, slightly west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 6, 1982; 8 σ , 4 f , Whale Creek on Rt 6, west of Murchison, Nov. 7, 1982; 2 σ , 3 f , same data as holotype; 1 σ , 1 f , small creek on Rt 6, approx. 10 km west of Havelock, Nov. 22, 1982; 2 f , tributary of Whangamoa River on Rt 6, just west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 22, 1982; 1 f , tributary of the Motupiko River on Rt 6, between Korere and Glenhope, Nov. 25, 1982.

Discussion: Males of the present species and the following are closely related (see remarks under the latter for characters separating the two) and may be distinguished from the type species, *U. projecta* hopkins, in having a posteromedial projection on the ventral shield in males (compare figures 484 and 489 with 502), and much less stocky segments of the male fourth leg (compare figures 483 and 488 with 494). Females of the present species have a proportionally much longer and narrower P-III than in *projecta* (compare figures 491 and 492).

80. Uralbia parva, new species

(Figs. 488-490, 493)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield 278 μm in length, 243 μm in width; anteromedial plate bearing the laterally placed postocularia; anterolateral platelets with one pair of glandularia; posterolateral platelets with the homologs of one pair of glandularia, but the gland portions have disappeared leaving only the associated setae; posteromedial plate with the homologs of two pairs of glandularia (fig. 490); excretory pore located on dorsal side of ventral shield; ventral shield 486 μm in length, 266 μm in width; anterior coxae projecting far forward and pointed; capitular bay very long and narrow; glands of the fourth coxae located at edge of suture lines between the third and fourth coxae; projections associated with insertions of fourth legs rounded and pointed posteromedially; posterior suture lines of fourth coxae evident for a short distance medial to insertions of fourth legs; genital field projecting beyond body; genital field consisting of paired posteriorly directed, pointed lobes bearing the acetabula; gonopore very small and tapering posteriorly when viewed ventrally; end of ventral shield with a pointed, triangular projection bearing a ventral keel; genital field area better illustrated (fig. 489) than described; dorsal lengths of the palpal segments: P-I, 55 μm ; P-II, 87 μm ; P-III, 79 μm ; P-IV, 207 μm ; P-V, 27 μm ; a few long, sharp cuticular projections on ventral side of P-II; figure 493 illustrates the proportions and chaetotaxy of the palp; capitulum 124 μm in length; chelicera 100 μm in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, 73 μm ; I-Leg-5, 104 μm ; I-Leg-6, 115 μm ; dorsal lengths of the segments of the fourth leg: IV-Leg-1, 103 μm ; IV-Leg-2, 140 μm ; IV-Leg-3, 105 μm ; IV-Leg-4, 148 μm ; IV-Leg-5, 177 μm ; IV-Leg-6, 143 μm ; segments of fourth leg relatively narrow as in the previous species; medial surface of IV-Leg-3 and 4 bearing many setae, but these not nearly as numerous as in the previous species (compare figures 483, 488).

Female: Unknown.

Holotype: Adult σ , Waimana River in the "Gorge" between Tameatura and Opotiki, North Island, Oct. 28, 1982.

Discussion: The present species is closely related to *gracilipes* but is much smaller and varies in details of the genital field region. The posteriorly directed lobes of the present species are more sharply pointed and bear fewer acetabula, and the gonopore is much narrower. Also, the posterior projection of the ventral shield is comparatively much larger in *parva*. The fourth leg of the present species bears fewer setae on IV-Leg-3 and 4 than in the related species.

81. Uralbia projecta Hopkins

(Figs. 491, 494-499, 502)

Uralbia projecta Hopkins, 1967. Trans. Royal Soc. New Zealand, 10: 44.

Male: Integumental pigment absent, eye pigment reduced; dorsal shield 369 μm -410 μm in length, 319 μm -350 μm in width; anteromedial plate bearing the laterally placed postocularia; anterolateral platelets with one pair of glandularia, the associated setae long; posteromedial platelets with the homologs of a pair of glandularia, but the gland portion has disappeared leaving the associated setae to mark the location; posteromedial plate with the homologs of two pairs of gland-

ularia, but here also the gland portions have disappeared leaving only the associated setae (fig. 498); excretory pore placed on dorsal portion of ventral shield; ventral shield $608\mu\text{m}$ - $637\mu\text{m}$ in length, $380\mu\text{m}$ - $395\mu\text{m}$ in width; anterior coxae projecting far forward and are pointed; capitular bay long and narrow; glands of the fourth coxae placed near suture lines of third coxae; projections associated with insertions of fourth legs rounded and located near lateral edges of body; posterior suture lines of fourth coxae well developed; genital field projecting beyond body; genital field consisting of posteriorly-directed lobes bearing the acetabula; gonopore located where the two lobes join anteriorly; end of ventral shield lacking the median projection so characteristic of the previous two species; genital field area better illustrated (fig. 502) than described; dorsal lengths of the palpal segments: P-I, $60\mu\text{m}$ - $69\mu\text{m}$; P-II, $100\mu\text{m}$ - $107\mu\text{m}$; P-III, $76\mu\text{m}$ - $79\mu\text{m}$; P-IV, $229\mu\text{m}$ - $256\mu\text{m}$; P-V, $28\mu\text{m}$ - $32\mu\text{m}$; palp as illustrated for the female; capitulum $141\mu\text{m}$ - $155\mu\text{m}$ in length; chelicera $121\mu\text{m}$ - $125\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $88\mu\text{m}$ - $90\mu\text{m}$; I-Leg-5, $111\mu\text{m}$ - $118\mu\text{m}$; I-Leg-6, $124\mu\text{m}$ - $128\mu\text{m}$; dorsal lengths of the segments of the fourth leg: IV-Leg-1, $118\mu\text{m}$ - $133\mu\text{m}$; IV-Leg-2, $185\mu\text{m}$ - $207\mu\text{m}$; IV-Leg-3, $144\mu\text{m}$ - $155\mu\text{m}$; IV-Leg-4, $177\mu\text{m}$ - $199\mu\text{m}$; IV-Leg-5, $207\mu\text{m}$ - $222\mu\text{m}$; IV-Leg-6, $155\mu\text{m}$ - $168\mu\text{m}$; leg segments stocky and with patches of thickened setae on medial surfaces of IV-Leg-3 and 4; these setae foreshortened in figure 494, figure 499 shows the true length of the thickened setae on IV-Leg-4.

Female: Integumental pigment absent, eye pigment reduced; dorsal shield $440\mu\text{m}$ - $471\mu\text{m}$ in length, $312\mu\text{m}$ - $334\mu\text{m}$ in width; structure of dorsal shield as described for male but posteromedial plate proportionally much longer and it bears the excretory pore; figure 495 shows the proportions of the sclerites of the dorsal shield; ornamentation of the dorsal shield similar to that of *U. gracilipes* (fig. 600); ventral shield $612\mu\text{m}$ - $669\mu\text{m}$ in length, $342\mu\text{m}$ - $380\mu\text{m}$ in width; anterior portion of ventral shield as described for male; suture lines of fourth coxae less well developed than in male and distance from fourth coxae to posterior end much greater; gonopore terminal and relatively large; many acetabula present, most of which are terminal in position (fig. 496); dorsal lengths of the palpal segments: P-I, $62\mu\text{m}$ - $69\mu\text{m}$; P-II, $97\mu\text{m}$ - $104\mu\text{m}$; P-III, $74\mu\text{m}$ - $79\mu\text{m}$; P-IV, $222\mu\text{m}$ - $237\mu\text{m}$; P-V, $31\mu\text{m}$ - $33\mu\text{m}$; ventral side of P-II with several long, sharp cuticular projections; capitulum $148\mu\text{m}$ - $157\mu\text{m}$ in length; chelicera $128\mu\text{m}$ - $135\mu\text{m}$ in length; figure 491 shows a lateral view of the capitulum, chelicera and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $76\mu\text{m}$ - $82\mu\text{m}$; I-Leg-5, $104\mu\text{m}$ - $106\mu\text{m}$; I-Leg-6, $109\mu\text{m}$ - $112\mu\text{m}$; figure 497 shows these segments.

Material Examined: NORTH ISLAND: 1 ♂, stream on Wainui Rd, 5 km west of Mahinepua Rd in northern North Island, Oct. 22, 1982; 1 ♀, tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), Oct. 27, 1982; SOUTH ISLAND: 2 ♀, tributary of Wakamarina River 7 km south-east of Canvastown (off Rt 6), Nov. 5, 1982; 1 ♂, 1 ♀, Graham Stream on Rt 6, at picnic grounds 8 km northeast of Whangamoa Saddle, Nov. 23, 1982; 2 ♂, 2 ♀, Whangamoa River on Rt 6, approx. 5 km northeast of Whangamoa Saddle, Nov. 23, 1982.

Discussion: The thickened fourth leg and lack of a median projection at the posterior end of the ventral shield is diagnostic for the male of the present species. The present female may be distinguished from *gracilipes* (female of *parva* unknown) by its proportionally much shorter P-III and the proportions of the sclerites of the dorsal shield. In *projecta*, the posterolateral plate is proportionally much longer and the posterior tips of the posterolateral platelets end much farther anteriorly (compare figures 485, 495).

Genus ZELANDALBIA Imamura

Zelandalbia Imamura, 1978. Jour. Speleolog. Soc. Japan, 3: 41.

Diagnosis (Based on female only, male unknown): Characters of the New Zealand Notoaturinae; anteromedial plate large and bearing the close set postocularia; both the anterolateral and posterolateral platelets each bearing a pair of glandularia; posteromedial plate with two pairs of glandularia (fig. 500); excretory pore lying on the posteromedial plate in female; dorsum without ornamentation (fig. 601); first coxae sharp-pointed and projecting beyond body in the type species but not to the anterior end in the species described in this paper; suture lines of fourth coxae obliterated; projections associated with insertions of fourth legs large and rounded; glands of the fourth coxae near suture lines between third and fourth coxae; female gonopore terminal; several pairs of genital acetabula present; genital field distinctly set off from remainder of ventral shield in type species but not in second species to be described in this paper; palpal segments elongated in the type species, shorter in the second species; without projections on ventral side of P-II; leg segments dorsoventrally expanded and laterally compressed (figs. 503, 505); no intercoxal slots present.

Type Species: *Zelandalbia hopkinsi* (Imamura).

Discussion: The dorsoventrally expanded and laterally compressed condition of the legs is superficially similar to that found in *Planaturus* and *Taintaturus*, but the second segment is not elongated on the fourth leg of the present genus and there are no intercoxal slots to receive the legs. There is no question but this compressed condition of the legs has evolved twice in very unrelated groups within the subfamily Notoaturinae. *Zelandalbia* was originally described as a subgenus of *Uralbia* but the differences seem sufficient to deserve generic separation.

82. *Zelandalbia imamurai*, new species

(Figs. 500, 501, 503-505, 509, 601)

Female: Integumental pigment absent, eye pigment reduced; dorsal shield 300 μ m in length, 237 μ m in width; anteromedial plate bearing the postocularia and lightly fused anteriorly with the ventral shield; anterolateral and posterolateral platelets each bearing a glandularium; posteromedial plate with two pairs of glandularia; all associated setae short; posterior end of posteromedial plate indented to accommodate a portion of the gonopore; excretory pore lying on the posteromedial plate; figures 500 and 601 show the structure of the dorsum; ventral shield 333 μ m in length, 264 μ m in width; anterior coxae moderately long and pointed, but not extending beyond edge of body; a ridge present on each side extending anterolaterally from region of third coxae; glands of the fourth coxae placed near suture lines between third and fourth coxae; projections associated with insertions of fourth legs rounded and directed posterolaterally; a ridge on each side extending posterolaterally from region of insertion of fourth legs; two pairs of glandularia close together on their respective sides located at posterior end of these ridges; gonopore terminal; genital acetabula located at posterior end; figure 501 illustrates the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 24 μ m; P-II, 40 μ m; P-III, 31 μ m; P-IV, 65 μ m; P-V, 31 μ m; structure of palp and its chaetotaxy very simple (fig. 509); capitulum 83 μ m in length; chelicera 86 μ m in length; figure 504 shows a lateral view of the

capitulum; dorsal lengths of the segments of the first leg: I-Leg-1, 31 μ m; I-Leg-2, 27 μ m; I-Leg-3, 28 μ m; I-Leg-4, 36 μ m; I-Leg-5, 38 μ m; I-Leg-6, 48 μ m; segments tending to be high and laterally compressed; figure 503 shows the structure of the first leg, but second and third legs are very similar; dorsal lengths of the segments of the fourth leg: IV-Leg-1, 24 μ m; IV-Leg-2, 26 μ m; IV-Leg-3, 26 μ m; IV-Leg-4, 27 μ m; IV-Leg-5, 25 μ m; IV-Leg-6, 41 μ m; figure 505 illustrates these segments.

Male: Unknown.

Holotype: Adult ♀, from Cole Creek on Rt 6, between Lake Moeraki and Haast, South Island, Nov. 10, 1982.

Discussion: The legs of the present species are similar to those illustrated for *Z. hopkinsi* (Imamura) but the palp, though similar in general structure and chaetotaxy, is much shorter. *Z. hopkinsi* has palpal proportions more like those found in *Uralbia*. Imamura's species has a proportionally longer body, a much broader anterior rim of the ventral shield, the genital field distinctly set off from the remainder of the body and the glandularia of the posterior portion of the ventral shield arranged very differently.

Family MOMONIIDAE Viets

Genus NEOMOMONIA Cook

Neomomonía Cook, 1968. Proc. Ent. Soc. Washington, 70: 211.

Diagnosis: Characters of the family Momoniidae as given by Cook (1974); dorsal and ventral shields present; dorsal shield divided into a smaller anterior plate and much larger posterior plate; all coxae solidly fused with ventral shield; three pairs of acetabula; acetabula lying on acetabular plates lying free in the integument in the female; female acetabular plates extending decidedly posterolaterally and followed by a large posterior plate which incorporates the postgenital sclerite, excretory pore and a pair of glandularia (fig. 506); male genital field completely fused with the ventral shield, but the acetabula lying free but relatively close together medially in the narrow gonopore (fig. 507); generally with numerous long setae in patches posterior to the insertions of the fourth legs and a small rounded clear area in the integument lateral to these setae (but both these structures reduced in one of the species); I-Leg-6 only slightly widened laterally to medially; P-V with two heavy terminal setae of approximately the same size.

Type Species: *Neomomonía torquipes* (Hopkins).

Discussion: *Neomomonía* was originally described as a subgenus of *Stygomonía*. However, with males now taken for the first time, and these with the genital acetabula lying free in the gonopore, it is obvious that the New Zealand mites must be shifted from the Stygomonomiinae to the Momoniinae. *Neomomonía* differs from both *Momonía* and *Momoniella* in being a much more dorso-ventrally flattened, colorless interstitial group in which P-V has two distal heavy setae of about equal size (fig. 510). The other two genera have one seta at tip of P-V much larger than the rest (fig. 533). Also, the anterior coxal groups are separated from the remainder of the ventral shield by articular membrane in *Momonía*. *Momoniella* has an entire dorsal shield, a greater development of the dorsal portion of the camerostome plus a very different arrangement of the dorsal glandularia. As far as is known, *Neomomonía* is confined to New Zealand.

83. Neomomonía torquipes (Hopkins)

(Figs. 506-508, 510, 513)

Stygomononia torquipes Hopkins, 1966. Trans. Royal Soc. New Zealand, 8: 115.
Stygomononia (Neomononia) torquipes Cook, 1968. Proc. Ent. Soc. Washington, 70: 211.

Male: Integumental pigment absent, eye pigment developed; dorsal shield $562\mu\text{m}$ - $566\mu\text{m}$ in length, $365\mu\text{m}$ - $376\mu\text{m}$ in width; dorsal shield divided into a smaller anterior plate and a much larger posterior plate; anterior plate $141\mu\text{m}$ - $148\mu\text{m}$ in length, $300\mu\text{m}$ - $305\mu\text{m}$ in width; posterior plate bearing three pairs of glandularia and is closely flanked by five pairs of glandularia sclerites (fig. 508); ventral shield $623\mu\text{m}$ - $631\mu\text{m}$ in length, $401\mu\text{m}$ - $414\mu\text{m}$ in width; anterior coxae projecting beyond body; suture lines between third and fourth coxae extending anterolaterally more or less in a gradual arc; projections associated with the insertions of fourth legs well developed; a patch of 8-10 long setae on each side posterior to insertions of fourth legs; a small clear area in the integument on each side immediately lateral to the bases of these setae; gonopore $96\mu\text{m}$ in length; three pairs of genital acetabula, these nearly touching in the midline; excretory pore terminal; figure 507 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$ - $19\mu\text{m}$; P-II, $66\mu\text{m}$ - $68\mu\text{m}$; P-III, $37\mu\text{m}$ - $38\mu\text{m}$; P-IV, $65\mu\text{m}$ - $69\mu\text{m}$; P-V, $38\mu\text{m}$ - $39\mu\text{m}$; structure of palp as described and illustrated for female; dorsal lengths of the distal segments of the first leg: I-Leg-4, $71\mu\text{m}$ - $74\mu\text{m}$ (greatest height of this segment $35\mu\text{m}$ - $37\mu\text{m}$); I-Leg-5, $145\mu\text{m}$ - $156\mu\text{m}$; I-Leg-6, $76\mu\text{m}$ - $80\mu\text{m}$; dorsal projection at proximal end of I-Leg-6 almost directly above origin of this segment; the two pointed extensions on this dorsal projection relatively far apart; subapical lobe of claw placed rather far proximal to tip; morphology of first leg as shown for female.

Female: Dorsum as described for male; dorsal shield $517\mu\text{m}$ - $593\mu\text{m}$ in length, $364\mu\text{m}$ - $410\mu\text{m}$ in width; anterior plate of dorsal shield $129\mu\text{m}$ - $162\mu\text{m}$ in length, $299\mu\text{m}$ - $337\mu\text{m}$ in width; ventral shield $562\mu\text{m}$ - $638\mu\text{m}$ in length, $380\mu\text{m}$ - $456\mu\text{m}$ in width; except for genital field region, ventral shield as described for male; posterior margins of fourth coxae more rounded and much farther anterior to genital field than in male; three pairs of genital acetabula, these located on small sclerites and arranged in an outward curve; postgenital sclerite fused with a broad, arc-like sclerite which bears the excretory pore and a pair of glandularia (fig. 506); dorsal lengths of the palpal segments: P-I, $17\mu\text{m}$ - $20\mu\text{m}$; P-II, $63\mu\text{m}$ - $66\mu\text{m}$; P-III, $38\mu\text{m}$ - $42\mu\text{m}$; P-IV, $64\mu\text{m}$ - $70\mu\text{m}$; P-V, $36\mu\text{m}$ - $41\mu\text{m}$; P-II relatively long and P-IV of nearly uniform height along entire length; two thickened setae at tip of P-V and two smaller thickened setae placed more proximally; figure 510 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $69\mu\text{m}$ - $73\mu\text{m}$ (greatest height of this segment $34\mu\text{m}$ - $35\mu\text{m}$); I-Leg-5, $142\mu\text{m}$ - $158\mu\text{m}$; I-Leg-6, $78\mu\text{m}$ - $86\mu\text{m}$; figure 513 illustrates these segments.

Material Examined: NORTH ISLAND: 1 ♂, 1 ♀, Te Whaiiau Stream at junction of Rt 47 and Rotoaria Rd, June 5, 1981; 1 ♂, 1 ♀, stream 1 km north of Tohere (east of Opotiki on Rt 35), Oct. 29, 1982; 1 ♀, stream at Owiritoa Bridge, on Rt 2 in "Gorge" south of Opotiki, Oct. 29, 1982; 1 ♀, stream at Sandy's Bridge on Rt 2, in "Gorge" south of Opotiki, Oct. 29, 1982; 1 ♂, Makakomiko Stream on Rt 4 (1 km south of Erua), between Erua and National Park, Nov. 2, 1982; SOUTH ISLAND: 1 ♀, tributary of Whangamoa River slightly west of Rai Saddle (at Col-

lins Valley Picnic Grounds), Nov. 6, 1982; 1 ♀, tributary of Motupiko River, on Rt 6 between Korere and Glenhope, 1982.

Discussion: The combination of a proportionally long P-IV of relatively uniform height (fig. 510) and a I-Leg-6 with the dorsal projection more or less above insertion of the segment (with the pointed extensions of this projection relatively far apart) are diagnostic for the present species.

84. Neomomonía hopkinsi, new species

(Figs. 511, 512, 514, 515)

Female: Integumental pigment absent, eye pigment developed; dorsal shield 441 μ m in length, 324 μ m in width; dorsal shield divided into a smaller anterior plate and a much larger posterior plate; anterior plate 133 μ m in length, 285 μ m in width; posterior plate bearing three pairs of glandularia and is closely flanked by five pairs of glandularia sclerites (fig. 512); ventral shield 471 μ m (592 μ m) in length, 365 μ m (456 μ m) in width; anterior coxae projecting beyond body, these with a ridge extending part way posteriorly from tips; suture line between third and fourth coxae abruptly angled near insertions of fourth legs; projections associated with insertions of fourth legs well developed; a patch of 4-5 (6-7) setae on each side posterior to insertions of fourth legs, these tend to be shorter than in other members of the genus; clear area in integument (so obvious in other members of the genus) reduced nearly to the point of being absent; three pairs of genital acetabula, these located on small sclerites and arranged nearly in a straight line which extends posterolaterally; postgenital sclerite fused with an arc-like sclerite which bears the excretory pore and a pair of glandularia; figure 511 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 15 μ m (20 μ m); P-II, 40 μ m (48 μ m); P-III, 22 μ m (29 μ m); P-IV, 45 μ m (56 μ m); P-V, 31 μ m (39 μ m); P-IV noticeably expanded distally (it would appear as in figure 519 if the segment were not rotated in the specimen illustrated); two thickened setae at tip of P-V and two smaller thickened setae placed more proximally; figure 514 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, 62 μ m (76 μ m); greatest height of this segment 35 μ m (40 μ m); I-Leg-5, 128 μ m (159 μ m); I-Leg-6, 65 μ m (79 μ m); dorsal projection at proximal end of I-Leg-6 placed nearly directly above origin of segment; the two pointed extensions on the dorsal projection relatively close together; subapical lobe of claw placed rather close to tip; figure 515 shows the proportions and chaetotaxy of these segments.

Male: Unknown.

Holotype: Adult ♀, from a tributary of the Waiwawa River at AA Rest Stop, 3 km west of Coroglen (Coromandel Peninsula), North Island, Oct. 27, 1982.

Paratype: 1 ♀, headwaters of Whangamata Stream, 10 km northwest of Taupo, North Island, Nov. 3, 1982.

Discussion: The combination of abruptly angled suture lines between third and fourth coxae, dorsal projection on I-Leg-6 located directly above insertion (and with the two extensions close together), and noticeably expanded ventral side of P-IV, are diagnostic for the present species. The paratype specimen is noticeably larger but otherwise agrees well with the holotype. Unfortunately, the dorsal shield of the paratype was lost during slide making and so comparisons of this structure were not possible. There is, therefore, the possibility that the two specimens actually belong to separate species.

85. Neomomonía benova, new species

(Figs. 516-520)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $513\mu\text{m}$ ($494\mu\text{m}$ - $502\mu\text{m}$) in length, $388\mu\text{m}$ ($358\mu\text{m}$ - $373\mu\text{m}$) in width; dorsal shield divided into a smaller anterior plate and a much larger posterior plate; anterior plate $133\mu\text{m}$ ($135\mu\text{m}$ - $140\mu\text{m}$) in length, $318\mu\text{m}$ ($289\mu\text{m}$ - $303\mu\text{m}$) in width; posterior plate bearing three pairs of glandularia and closely flanked by five pairs of glandularia sclerites; dorsal shield as shown for female; ventral shield $564\mu\text{m}$ ($540\mu\text{m}$ - $570\mu\text{m}$) in length, $418\mu\text{m}$ ($395\mu\text{m}$ - $403\mu\text{m}$) in width; anterior coxae projecting beyond body; suture lines between third and fourth coxae extending anterolaterally more or less in an arc; projections associated with insertions of fourth legs well developed; a patch of six to eight long setae on each side posterior to insertions of fourth legs; a clear area in the integument on each side immediately lateral to these setal patches; gonopore $81\mu\text{m}$ in length and noticeably narrowed to a point posteriorly (fig. 518); three pairs of genital acetabula, these nearly touching in the midline; excretory pore terminal; dorsal lengths of the palpal segments: P-I, $15\mu\text{m}$ ($14\mu\text{m}$ - $15\mu\text{m}$); P-II, $50\mu\text{m}$ ($45\mu\text{m}$ - $48\mu\text{m}$); P-III, $31\mu\text{m}$ ($29\mu\text{m}$ - $33\mu\text{m}$); P-IV, $55\mu\text{m}$ ($48\mu\text{m}$ - $52\mu\text{m}$); P-V, $34\mu\text{m}$ ($31\mu\text{m}$ - $34\mu\text{m}$); structure of palp as described and illustrated for female; dorsal lengths of the distal segments of the first leg: I-Leg-4, $69\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); greatest height of this segment, $35\mu\text{m}$ ($31\mu\text{m}$ - $35\mu\text{m}$); I-Leg-5, $159\mu\text{m}$ ($152\mu\text{m}$ - $159\mu\text{m}$); I-Leg-6, $111\mu\text{m}$ ($107\mu\text{m}$ - $109\mu\text{m}$); dorsal projection at proximal end of I-Leg-6 extending well proximal to the origin of the segment; the two pointed extensions of this dorsal projection relatively far apart; subapical lobe of claw placed rather far proximally to tip; the morphology of the first leg as illustrated for the female.

Female: Dorsal shield as described for male; dorsal shield $532\mu\text{m}$ ($532\mu\text{m}$ - $547\mu\text{m}$) in length, $380\mu\text{m}$ ($386\mu\text{m}$ - $402\mu\text{m}$) in width; anterior plate of dorsal shield $140\mu\text{m}$ ($137\mu\text{m}$ - $140\mu\text{m}$) in length, $314\mu\text{m}$ ($318\mu\text{m}$ - $333\mu\text{m}$) in width; ventral shield $581\mu\text{m}$ ($577\mu\text{m}$ - $581\mu\text{m}$) in length, $434\mu\text{m}$ ($440\mu\text{m}$ - $446\mu\text{m}$) in width; except for genital field region, ventral shield as described for male; posterior margins of fourth coxae much farther from genital field than in male; three pairs of genital acetabula, these located on small sclerites and arranged in outwardly directed arcs; postgenital sclerite fused with a broad arc-like sclerite which also bears the excretory pore and a pair of glandularia (fig. 517); dorsal lengths of the palpal segments: P-I, $15\mu\text{m}$ ($15\mu\text{m}$ - $17\mu\text{m}$); P-II, $50\mu\text{m}$ ($49\mu\text{m}$ - $50\mu\text{m}$); P-III, $31\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); P-IV, $58\mu\text{m}$ ($52\mu\text{m}$ - $55\mu\text{m}$); P-V, $38\mu\text{m}$ ($35\mu\text{m}$ - $37\mu\text{m}$); P-IV noticeably expanded in distal half; two thickened setae at tip of P-V and two smaller thickened setae placed more proximally; figure 519 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $66\mu\text{m}$ ($64\mu\text{m}$ - $69\mu\text{m}$); greatest height of this segment $37\mu\text{m}$ ($35\mu\text{m}$ - $38\mu\text{m}$); I-Leg-5, $166\mu\text{m}$ ($156\mu\text{m}$ - $162\mu\text{m}$); I-Leg-6, $110\mu\text{m}$ ($108\mu\text{m}$ - $114\mu\text{m}$); these segments as described for male (fig. 516).

Holotype: Adult ♂, from a stream 1 km north of Tohere (east of Opotiki), North Island, Oct. 29, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 1 ♂, 1 ♀, stream on Wainui Rd, 5 km west of Mahinepua Rd, northern North Island, Oct. 22, 1982; 1 ♀, stream at Owihiritoa Bridge on Rt 2, in "Gorge" south of Opotiki, Oct. 29, 1982; SOUTH ISLAND: 3 ♂, tributary of Whangamoa River on Rt 6, slightly west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 6, 1982; 1 ♂, small creek on Rt 6, approx 10

km west of Havelock, Nov. 22, 1982; 1 ♀, tributary of Whangamoa River on Rt 6, just west of Rai Saddle (at Collins Valley Picnic Grounds), Nov. 22, 1982; 1 ♀, Whangamoa River on Rt 6, approx 5 km northeast of Whangamoa Saddle, Nov. 23, 1982.

Discussion: The present species seems most closely related to the following species. See remarks under the latter for characters which will distinguish the two. The present species differs from the two previously described species in having the dorsal projection on I-Leg-6 extending well proximal to insertion of the segment and in having the clear area lateral to the setal patch of the ventral shield much larger.

86. Neomomonía paramecia, new species

(Figs. 521-524, 526)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield $456\mu\text{m}$ ($426\mu\text{m}$ - $441\mu\text{m}$) in length, $288\mu\text{m}$ ($251\mu\text{m}$ - $315\mu\text{m}$) in width; dorsal shield divided into a smaller anterior plate and a much larger posterior plate; anterior plate $133\mu\text{m}$ ($111\mu\text{m}$ - $126\mu\text{m}$) in length, $251\mu\text{m}$ ($215\mu\text{m}$ - $266\mu\text{m}$) in width; posterior plate with three pairs of glandularia and closely flanked by five pairs of glandularia sclerites; figure 521 shows the structure of the dorsal shield; ventral shield $517\mu\text{m}$ ($456\mu\text{m}$ - $492\mu\text{m}$) in length, $319\mu\text{m}$ ($285\mu\text{m}$ - $364\mu\text{m}$) in width; anterior coxae projecting beyond body; suture lines between third and fourth coxae extending anterolaterally more or less in an arc; projections associated with insertions of fourth legs well developed; a patch of seven to eight long setae on each side posterior to insertions of fourth legs; a distinct clear area on each side immediately lateral to the setal patches; gonopore $92\mu\text{m}$ ($77\mu\text{m}$ - $89\mu\text{m}$) in length, and is relatively wide and rounded posteriorly (fig. 523); three pairs of genital acetabula, these nearly touching medially; excretory pore terminal; dorsal lengths of the palpal segments: P-I, $13\mu\text{m}$ ($13\mu\text{m}$ - $14\mu\text{m}$); P-II, $40\mu\text{m}$ ($39\mu\text{m}$ - $41\mu\text{m}$); P-III, $24\mu\text{m}$ ($25\mu\text{m}$ - $26\mu\text{m}$); P-IV, $43\mu\text{m}$ ($41\mu\text{m}$ - $45\mu\text{m}$); P-V, $30\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); P-IV noticeably expanded distally; two thickened setae at tip of P-V and two smaller thickened setae placed more proximally; figure 522 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $55\mu\text{m}$ ($55\mu\text{m}$ - $59\mu\text{m}$); greatest height of this segment, $31\mu\text{m}$ ($29\mu\text{m}$ - $31\mu\text{m}$); I-Leg-5, $145\mu\text{m}$ ($128\mu\text{m}$ - $140\mu\text{m}$); I-Leg-6, $116\mu\text{m}$ ($111\mu\text{m}$ - $124\mu\text{m}$); dorsal projection on proximal portion of I-Leg-6 extending well proximal to origin of this segment; the two pointed extensions on this dorsal projection relatively far apart; subapical lobe of claw placed rather far proximal to tip; figure 524 shows the proportions and chaetotaxy of these segments.

Female: Dorsal shield as described for male; dorsal shield $426\mu\text{m}$ ($395\mu\text{m}$ - $440\mu\text{m}$) in length, $247\mu\text{m}$ ($239\mu\text{m}$ - $327\mu\text{m}$) in width; anterior plate of dorsal shield $118\mu\text{m}$ ($111\mu\text{m}$ - $118\mu\text{m}$) in length, $217\mu\text{m}$ ($199\mu\text{m}$ - $273\mu\text{m}$) in width; ventral shield $460\mu\text{m}$ ($436\mu\text{m}$ - $486\mu\text{m}$) in length, $282\mu\text{m}$ ($274\mu\text{m}$ - $360\mu\text{m}$) in width; except for genital field region, ventral shield as described for male; posterior margins of fourth coxae much farther from the genital field than in the male; three pairs of genital acetabula, these located on small sclerites and arranged in an outwardly directed arc; postgenital sclerite fused with a broad arc-like sclerite which bears the excretory pore and a pair of glandularia (fig. 526); dorsal lengths of the palpal segments: P-I, $13\mu\text{m}$ ($12\mu\text{m}$ - $14\mu\text{m}$); P-II, $37\mu\text{m}$ ($35\mu\text{m}$ - $41\mu\text{m}$); P-III, $24\mu\text{m}$ ($24\mu\text{m}$ - $26\mu\text{m}$); P-IV, $41\mu\text{m}$ ($38\mu\text{m}$ - $44\mu\text{m}$); P-V, $27\mu\text{m}$ ($27\mu\text{m}$ - $30\mu\text{m}$); structure of palp as described and illustrated for male; dorsal lengths of the distal seg-

ments of the first leg: I-Leg-4, $54\mu\text{m}$ ($55\mu\text{m}$ - $57\mu\text{m}$); greatest height of this segment $29\mu\text{m}$ ($30\mu\text{m}$ - $32\mu\text{m}$); I-Leg-5, $128\mu\text{m}$ ($131\mu\text{m}$ - $145\mu\text{m}$); I-Leg-6, $110\mu\text{m}$ ($106\mu\text{m}$ - $117\mu\text{m}$); these segments as shown and described for male.

Holotype: Adult ♂, Four Mile River on Rt 6, between Charleston and Tiro-noana, South Island, Nov. 8, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: NORTH ISLAND: 1 ♀, stream at Owhiritoa Bridge on Rt 2, in the "Gorge" south of Opotiki, Oct. 29, 1982; 1 ♂, 2 ♀, stream at Opato Bridge area (at rest stop), on Rt 2 south of Opotiki, Oct. 29, 1982; 1 ♀, Mangatokiiti Stream (Egmont area) on Opunake Rd, 10 km west of Stratford, Nov. 1, 1982; SOUTH ISLAND: 10 ♂, 2 ♀, tributary of Wakamarina River, 7 km southeast of Canvas-twon (off Rt 6), Nov. 5, 1982; 1 ♂, Opouri River between Carluke and Opouri Valley on Tennyson Inlet Rd, Nov. 6, 1982; 3 ♂, same data as holotype; 1 ♀, Potters Creek on Rt 6, between Bruce Bay and Lake Paringa (north of Haast), Nov. 10, 1982; 1 ♀, Rocky Gully Stream on Rt 8, between Cave and Fairlie (west of Timaru), Nov. 18, 1982; 1 ♂, Graham Stream on Rt 6, at picnic grounds 8 km northeast of Whangamoa Saddle, Nov. 23, 1982; 3 ♂, Whangamoa River on Rt 6, approx 5 km northeast of Whangamoa Saddle, Nov. 23, 1982; 1 ♂, 3 ♀, Wakapu-aka River on Rt 6, on western edge of Hira State Forest, Nov. 23, 1982.

Discussion: The present species is most closely related to the previous species, *N. benova*, but differs in being smaller and typically proportionally much narrower. Actually, most specimens are as narrow as, or are narrower than, indicated in figures 523 and 526. It is a single male and female specimen from an unnamed stream on Wianui Road, 5 km west of Mahinepua Road (in northern North Island) which are relatively wide (but otherwise agree with the characters of the present species) which produce the large width measurements in the para-type series. The male gonopore is rounded posteriorly in the present species and I-Leg-6 is much longer relative to I-Leg-5 in both sexes than in any other member of the genus.

Genus PARTIDOMOMONIA, new genus

Discussion: (Based on male, female unknown); characters of the family Momoniidae as given by Cook (1974); dorsal shield consisting of a series of closely fitting sclerites which are better illustrated (fig. 527) than described; gland portion missing on many of the dorsal glandularia; ventral shield entire; all coxae fused with the ventral shield; three pairs of genital acetabula, these lying free and widely separated medially in the oval male gonopore (fig. 529); male genital field incorporated into the ventral shield; setae posterolateral to openings for insertion of fourth legs short and few in number; I-Leg-6 with the dorsal projection elongated and extending 180° from distal portion (fig. 528); P-V with one terminal seta much longer than others.

Type Species: *Partidomomonina polyplacophora*, new species.

Discussion: The new genus likely belongs in the subfamily Momoniinae, but a knowledge of the female is necessary before this can be stated with certainty. It is a bit difficult to homologize the glandularia of the dorsal shield with those of *Neomomonina*. However, it appears the small anteromedial and following paired plates bearing the postocularia correspond to the anterior plate, and the larger paired plates plus the posteromedial plate correspond to the posterior plate of *Neomomonina*. It is likely that the lateral platelets bearing setae (homologs of glandularia) lateral to the postocularia platelets correspond to the glandularia opposite the suture line between anterior and posterior plates of the pre-

vious genus. The setae on the large paired plates and two pairs of setae on the posteromedial plate correspond to the glandularia on the posterior plate of *Neomomonionia*. However, there are only three pairs of glandularia (or their homologs) lateral to these large plates and there should be four pairs in order to homologize exactly with the condition found in the previous genus. If positions of the glandularia are relatively constant in the two genera, it is the second from the last pair of free glandularia in *Neomomonionia* that are missing in *Partidomonionia*.

A nymphal specimen of what is without doubt a second species of the present genus was taken from interstitial waters of a stream in Queensland, Australia.

87. Partidomonionia polyplacophora, new species

(Figs. 525, 527-529, 531)

Male: Integumental pigment absent, eye pigment greatly reduced; all body sclerites thin; dorsal shield $684\mu\text{m}$ in length, $502\mu\text{m}$ in width; dorsal shield consisting of numerous closely fitting sclerites which are better illustrated (fig. 527) than described; the presumed homologies of the glandularia and sclerites are discussed in the generic description; ventral shield $798\mu\text{m}$ in length, $523\mu\text{m}$ in width; anterior coxae projecting beyond body proper; projections associated with insertions of fourth legs well developed; three or four short setae on each fourth coxa posterior to insertions of fourth legs; no clear areas lateral to these setae; gonopore $81\mu\text{m}$ in length, $89\mu\text{m}$ in width; three pairs of genital acetabula, these lateral in position; gonopore closely flanked by 10-11 setae (or setal bases) on each side (fig. 529); excretory pore subterminal; figure 531 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I, $22\mu\text{m}$; P-II, $53\mu\text{m}$; P-III, $38\mu\text{m}$; P-IV, $72\mu\text{m}$; P-V, $51\mu\text{m}$; only one of the ventral setae on P-IV greatly thickened; only one of the end setae of P-V greatly enlarged; P-V bearing three smaller, thickened setae (fig. 525); dorsal lengths of the distal segments of the first leg: I-Leg-4, $100\mu\text{m}$; I-Leg-5, $248\mu\text{m}$; I-Leg-6, $259\mu\text{m}$; dorsal projection on proximal portion of I-Leg-6 greatly lengthened and extending at an angle of 180° from the distal portion of the segment; claw $148\mu\text{m}$ in length; structure of these segments of the first leg better illustrated (fig. 528) than described.

Female: Unknown.

Holotype: Adult σ , from a stream on Wainui Rd, 5 km west of Mahinepua Rd, northern North Island, Oct. 22, 1982.

Genus MOMONIELLA Viets

88. Momoniella sp.

(Figs. 530, 532, 533)

Newly Metamorphosed Nymph: dorsum too unsclerotized to describe, although "pores" are forming over an extensive area and it is obvious there will be a dorsal shield; ventral shield $608\mu\text{m}$ in length, $577\mu\text{m}$ in width; anterior coxae projecting, forming a camerostome with a somewhat concave anterior edge; tips of first coxae curving into a semicircular anterior rim; capitular bay relatively wide ($74\mu\text{m}$); provisional genital field consisting of two pairs of close-

ly spaced acetabula; figure 532 illustrates the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $19\mu\text{m}$; P-II, $54\mu\text{m}$; P-III, $38\mu\text{m}$; P-IV, $56\mu\text{m}$; P-V, $44\mu\text{m}$; ventral setae of P-IV consisting of one greatly thickened seta and one only slightly thickened seta; tip of P-V with one extremely large seta and a much smaller (but thickened) seta; figure 533 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $76\mu\text{m}$; I-Leg-5, $176\mu\text{m}$; I-Leg-6, $104\mu\text{m}$; figure 530 shows the structure of these segments.

Adults: Unknown.

Material Examined: 1 nymph, Whangamoa River on Rt 6, approx. 5 km northeast of the Whangamoa Saddle, South Island, Nov. 23, 1982.

Discussion: This single nymph from New Zealand is very similar to the nymph of one of the undescribed Australian members of the genus, and is characterized by a greatly enlarged terminal seta on P-V (fig. 533). As was discussed for the single nymph of *Oxus* taken (page 18), the present specimen may be in New Zealand as the result of chance dispersion rather than as part of an established population. Unfortunately, only further collecting in New Zealand will provide the answer. Members of this genus have been collected in West Africa, Indonesia, Australia and New Zealand, with species from the latter two areas belonging to a distinctive species group in which the tips of the anterior coxae are curved into semicircles (fig. 532).

Family MIDEOPSIDAE Koenike

Genus NUDOMIDEOPSIS Szalay

89. Nudomideopsis forkensis (Imamura)

(Figs. 534-537)

Mideopsis forkensis Imamura, 1977. Jour. Speleol. Soc. Japan, 2: 11.

Male: Dorsal shield $653\mu\text{m}$ in length, $532\mu\text{m}$ in width; dorsal shield darkly pigmented except for the central area; dorsal shield oval, the arrangement of the postocularia and glandularia better illustrated (fig. 535) than described; ventral shield $669\mu\text{m}$ in length, $562\mu\text{m}$ in width; gonopore foreshortened in ventral view; three pairs of acetabula; a short ridge on each side extending anterolaterally from region of the third coxae; epimeroglandularia 2 placed posterior to the fourth coxae; a pair of glandularia on the lateral borders of fourth coxae; epimeroglandularia 1 shifted anteriorly to suture line of first coxae; figure 537 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, $20\mu\text{m}$; P-II, $48\mu\text{m}$; P-III, $43\mu\text{m}$; P-IV, $111\mu\text{m}$; P-V, $34\mu\text{m}$; P-IV simple, without a ventral tubercle; the small ventral seta of P-IV is much more proximal in location on the palp not illustrated; figure 536 shows the structure of the palp; capitulum $93\mu\text{m}$ in length; chelicera $110\mu\text{m}$ in length; dorsal lengths of the distal segments of the first leg: I-Leg-4, $46\mu\text{m}$; I-Leg-5, $79\mu\text{m}$; I-Leg-6, $98\mu\text{m}$; figure 534 illustrates these segments; segments 2 and 3 of first three pairs of legs with long ventral setae but no true swimming hairs; IV-Leg-5 with one long seta which can be considered a swimming hair.

Female: See Imamura (1977).

Material Examined: 1 ♂, Waikohatu Stream on Rt 12, in Waipoua State Forest, northern North Island, May 29, 1981.

Discussion: Although the present male specimen is somewhat larger than

Imamura's female mite (and typically males of a species are smaller than the females), it agrees with the latter in general morphology. Until additional material is collected and species placement possibly proven wrong, they are considered conspecific. I am following Ian Smith's suggestion that *Nudomideopsis* be given full generic rank. The occurrence of the genus in New Zealand is an amazing bit of disjunct distribution. All other members are confined to the holarctic region, with the bulk of the species endemic to Japan.

Family UCHIDASTYGACARIDAE Imamura

Subfamily MORIMOTACARINAE Imamura

Genus AUSTRAMIDEOPSOIDES, new genus

The new genus appears to belong to the Morimotacarinae but necessitates revising the subfamily diagnosis as given by Cook (1974) as follows: Characters of the family Uchidastygacaridae; a well developed genital bay present; genital field either flanked by a pair of glandularia (epimeroglandularia 2) or these are placed anterolateral to the genital field; palp not rotated; P-IV may or may not be expanded but lacks a thickened ventral seta; claws present on fourth leg.

Generic Diagnosis: Characters of the subfamily Morimotacarinae; only the first coxae sharp-pointed; outer margins of second and third coxae only slightly extending in area of coxal tips; openings for insertion of fourth legs relatively close together and with no projections; IV-Leg-1 long, much longer than IV-Leg-6; posterior pairs of genital acetabula in male partially covered by fixed sclerites flanking the gonopore; anterior two pairs of acetabula well separated from the posterior pair (fig. 541); palp five segmented, with a hyaline ventral projection on P-II (and P-III in the New Zealand species).

Type Species: *Austramideopsoides serratipalpis*, new species.

Discussion: Two species belonging to this genus are known from New Zealand and a third (undescribed) species, lacking the lateral projections on the dorsal shield, has been collected in Tasmania. The present new genus, plus an additional new genus from Australia, exhibit character states which indicate a closer relationship between the Mideopsidae and Uchidastygacaridae (and the latter's subfamily Morimotacarinae) than was previously suspected. These relationships will be discussed in a paper dealing with the Australian water mites.

90. Austramideopsoides serratipalpis, new species

(Figs. 538-543, 548, 549)

Male: Integumental pigment absent, eye pigment reduced; dorsal shield 320 μm in length, 248 μm in width; dorsal shield oval and with a pair of lateral ridges; three pairs of glandularia on the dorsal shield; postocularia lying somewhat medial to first pair of glandularia; structure of dorsal shield as shown for the female; ventral shield 381 μm in length, 277 μm in width; first coxae projecting beyond body and with a dorsal hood forming a camerostome; tips of second and third coxae rounded; suture lines of fourth coxae Y-shaped; openings for insertion of fourth legs relatively close together medially and without associated projections; posterior suture lines of fourth coxae lightly indicated; lateral edges of ventral shield with sharp-pointed projections (fig. 539); epimeroglandularia 2 placed in a line with the anterior end of gonopore; genital field with three pairs

of acetabula, these arranged in two closely set anterior pairs which are well removed from posterior acetabula; medial edges of gonopore sclerites extending towards midline posterior to anterior groups of acetabula and partially covering the posterior acetabula (fig. 541); genital field flanked by six pairs of setae; the gonopore $45\mu\text{m}$ in length; dorsal lengths of the palpal segments: P-I, $10\mu\text{m}$; P-II, $38\mu\text{m}$; P-III, $19\mu\text{m}$; P-IV, $31\mu\text{m}$; P-V, $15\mu\text{m}$; structure of palp as illustrated and described for female; capitulum $90\mu\text{m}$ in length; chelicera $87\mu\text{m}$ in length; capitulum with a relatively long rostrum as in the female; dorsal lengths of the distal segments of the first leg: I-Leg-4, $41\mu\text{m}$; I-Leg-5, $52\mu\text{m}$; I-Leg-6, $73\mu\text{m}$; first leg as in female; first segment of fourth leg longer than the sixth segment; swimming hairs absent.

Female: Dorsum as described for male; dorsal shield $344\mu\text{m}$ in length, $266\mu\text{m}$ in width; ventral shield $407\mu\text{m}$ in length, $296\mu\text{m}$ in width; except for genital field region, female ventral shield as described for male; capitular bay $34\mu\text{m}$ in width; genital field with three pairs of acetabula lying on the ventral shield; three or four setae on each side of acetabula (fig. 543); gonopore approximately as wide as long, $38\mu\text{m}$ in width; dorsal lengths of the palpal segments: P-I, $19\mu\text{m}$; P-II, $37\mu\text{m}$; P-III, $21\mu\text{m}$; P-IV, $33\mu\text{m}$; P-V, $16\mu\text{m}$; both P-II and P-III with hyaline ventral projections of moderate length; ventral seta of P-IV hair-like and located in proximal portion of segment; ventral edge distal to seta appearing serrate; P-IV gradually tapering distally; figure 548 shows the proportions and chaetotaxy of the palp; capitulum $96\mu\text{m}$ in length; chelicera $98\mu\text{m}$ in length; figure 559 shows the prominent rostrum characteristic of this species; dorsal lengths of the distal segments of the first leg: I-Leg-4, $41\mu\text{m}$; I-Leg-5, $51\mu\text{m}$; I-Leg-6, $76\mu\text{m}$; figure 540 illustrates these segments; swimming hairs absent.

Holotype: Adult σ , from a tributary of the Wakamarina River, 7 km southeast of Canvastown (off Rt 6), South Island, Nov. 5, 1982.

Allotype: Adult f , headwaters of Whangamata Stream, 10 km northwest of Taupo, North Island, Nov. 3, 1982.

Discussion: See remarks under the following species for characters which will separate the known members of the genus.

91. Austramideopsoides ramsayi, new species

(Figs. 544-547, 550)

Female: Integumental pigment absent, eye pigment reduced; dorsal shield $300\mu\text{m}$ ($277\mu\text{m}$ - $311\mu\text{m}$) in length, $207\mu\text{m}$ ($192\mu\text{m}$ - $233\mu\text{m}$) in width; dorsal shield oval, with a pair of lateral ridges; three pairs of glandularia on dorsal shield; postocularia placed anteromedial to the first pair of glandularia; figure 550 shows a dorsal view of the mite; ventral shield $340\mu\text{m}$ ($333\mu\text{m}$ - $355\mu\text{m}$) in length, $241\mu\text{m}$ ($222\mu\text{m}$ - $251\mu\text{m}$) in width; first coxae projecting beyond body and with a dorsal hood forming a camerostome; capitular bay $24\mu\text{m}$ in width; tips of second and third coxae rounded; suture lines not distinct as in previous species; openings for insertion of fourth legs relatively close together medially and without associated projections; posterior suture lines of fourth coxae indistinct; epimeroglandularia 2 placed near these suture lines well anterior to genital field; pointed projections on lateral edges of ventral shield; genital field with three pairs of acetabula lying on the ventral shield; three or four setae on each side associated with acetabular region; gonopore small and somewhat longer than wide ($27\mu\text{m}$ in width); figure 546 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $9\mu\text{m}$ ($8\mu\text{m}$ - $11\mu\text{m}$); P-II, $26\mu\text{m}$ ($25\mu\text{m}$ - $28\mu\text{m}$); P-III, $15\mu\text{m}$

(15 μ m-18 μ m); P-IV, 22 μ m (21 μ m-27 μ m); P-V, 12 μ m (11 μ m-14 μ m); hyaline projection on ventral side of P-II and P-III relatively long; ventral seta on P-IV hair-like and located near distal end of segment; P-IV actually expanded towards distal end; figure 545 shows the proportions and chaetotaxy of the palp; capitulum 64 μ m (62 μ m-72 μ m) in length; chelicera 65 μ m (62 μ m-72 μ m) in length; rostrum much shorter than in previous species (fig. 547); dorsal lengths of the distal segments of the first leg: I-Leg-4, 38 μ m (36 μ m-39 μ m); I-Leg-5, 45 μ m (43 μ m-45 μ m); I-Leg-6, 69 μ m (66 μ m-69 μ m); figure 544 illustrates these segments; swimming hairs absent.

Male: Not known with certainty. A male, lacking mouthparts but with the narrow body and narrow capitular bay found in females of the present species, was collected in Potters Creek on Rt 6, between Bruce Bay and Lake Paringa (north of Haast), South Island. I hesitate to assign it to the present species when the more important taxonomic characters exhibited by the palp are not available. If it is the male of *ramsayi*, the ventral shield is similar to that of the related species.

Holotype: Adult ♀, headwaters of Whangamata Stream, 10 km northeast of of Taupo, North Island, Nov. 3, 1982.

Paratypes: NORTH ISLAND: 3 ♀, same data as holotype; SOUTH ISLAND: 1 ♀, Whale Creek on Rt 6, west of Murchison, Nov. 7, 1982; 1 ♀, Four Mile River on Rt 6, between Charleston and Tiromoana, Nov. 8, 1982; 1 ♀, Adamson Creek on Rt 6, between Lake Ianthe and Whanganui, Nov. 9, 1982; 1 ♀, MacLennan River at bridge on Aurora Creek Rd (Catlins State Forest area) between Puketiro and Rt 92, Nov. 12, 1982.

Discussion: Presently, three species of *Austramideopsoides* are known. An undescribed species from Tasmania differs in several characters but the most obvious is a lack of projections on the sides of the ventral shield, a character found in both New Zealand species.

As for characteristics separating the two New Zealand species, *N. ramsayi* and *N. serratipalpis*, differences in the mouthparts are most useful. Compare figures 545 and 548 for the differences in palps, and figures 547 and 549 for the differences in length of the rostrum. The females of the present species also have a proportionally narrower capitular bay and gonopore.

Family ARRENURIDAE Thor

Genus ARRENURUS Duges

92. Arrenurus zelandicus, new species

(Figs. 551, 552, 555, 556)

Female: Integumental pigment absent, eye pigment developed; dorsal shield 745 μ m (714 μ m) in length, 441 μ m (449 μ m) in width; dorsal shield bearing the postocularia and three pairs of glandularia; no dorsal tubercles on dorsal shield; body pores very small, with two to six pores sharing a common subcuticular opening; figure 555 shows a dorsal view; ventral shield 820 μ m (791 μ m) in length, 510 μ m (501 μ m) in width; body oval, without projections or humps; anterior coxae projecting beyond body; a few body pores present between the second and third coxae, and medially between the third and fourth coxae; acetabular plates 364 μ m (380 μ m) in width; gonopore 127 μ m (125 μ m) in length, 137 μ m (133 μ m) in width; four pairs of long setae on lateral margins of fourth coxae; figure 556 shows the

structure of the ventral shield; dorsal lengths of the palpal segments: P-I, $24\mu\text{m}$ ($22\mu\text{m}$); P-II, $59\mu\text{m}$ ($55\mu\text{m}$); P-III, $52\mu\text{m}$ ($48\mu\text{m}$); P-IV, $65\mu\text{m}$ ($63\mu\text{m}$); P-V, $42\mu\text{m}$ ($41\mu\text{m}$); figure 551 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $111\mu\text{m}$ ($110\mu\text{m}$); I-Leg-5, $110\mu\text{m}$ ($114\mu\text{m}$); I-Leg-6, $128\mu\text{m}$ ($136\mu\text{m}$); figure 552 shows these segments; IV-Leg-3 with three swimming hairs, IV-Leg-4 with two or three swimming hairs, IV-Leg-5 with four to six swimming hairs.

Male: Unknown.

Holotype: Adult ♀, Kaituna River on Rt 6, 5 km south of Havelock, northern South Island, Nov. 22, 1982.

Paratype: 1 ♀, same data as holotype.

Discussion: Until the male of this interstitial species is known, its affinities will remain uncertain, but it does show characteristics which are considered typical of *Truncaturus*.

93. Arrenurus (Arrenurus) stouti, new species

(Figs. 553, 554, 557-560)

Male: Integumental pigment present, eye pigment well developed; body, including petiole, $973\mu\text{m}$ ($927\mu\text{m}$ - $1003\mu\text{m}$) in length, $638\mu\text{m}$ ($623\mu\text{m}$ - $684\mu\text{m}$) in width; pygal lobes well developed and directed posteriorly; width between outer margins of pygal lobes $486\mu\text{m}$ ($479\mu\text{m}$ - $502\mu\text{m}$); dorsal shield $441\mu\text{m}$ ($445\mu\text{m}$ - $516\mu\text{m}$) in width; dorsal furrow passing onto sides of body; non-cauda portion of dorsal shield bearing two pairs of glandularia, the second pair associated with pointed dorsal humps; anterior end of body somewhat concave; a short, wide hyaline appendage present; petiole $155\mu\text{m}$ ($151\mu\text{m}$ - $155\mu\text{m}$) in length, $104\mu\text{m}$ ($110\mu\text{m}$ - $118\mu\text{m}$) in width; petiole broadening posteriorly, with numerous, sharp spine-like integumental projections on ventral side; structure of petiole better illustrated (figs. 557, 559) than described; acetabular plates extending well up onto sides of body; dorsal lengths of the palpal segments: P-I, $34\mu\text{m}$ ($31\mu\text{m}$ - $35\mu\text{m}$); P-II, $69\mu\text{m}$ ($69\mu\text{m}$ - $76\mu\text{m}$); P-III, $65\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); P-IV, $86\mu\text{m}$ ($93\mu\text{m}$ - $96\mu\text{m}$); P-V, $48\mu\text{m}$ ($50\mu\text{m}$ - $52\mu\text{m}$); palp similar to that illustrated for the female; dorsal lengths of the distal segments of the first leg: I-Leg-4, $162\mu\text{m}$ ($148\mu\text{m}$ - $164\mu\text{m}$); I-Leg-5, $155\mu\text{m}$ ($148\mu\text{m}$ - $157\mu\text{m}$); I-Leg-6, $222\mu\text{m}$ ($220\mu\text{m}$ - $244\mu\text{m}$); these leg segments proportionally longer than illustrated for the female and there are numerous short "swimming hairs" on I-Leg-6; IV-Leg-4 extending well beyond insertion of IV-Leg-5; swimming hairs present on second, third and fourth legs.

Female: Dorsal and ventral shields present, dorsal furrow complete; dorsal shield $577\mu\text{m}$ ($548\mu\text{m}$ - $577\mu\text{m}$) in width; dorsal shield bearing the postocularia and three pairs of glandularia, third pair of glandularia on small bumps; body somewhat projecting anteriorly and concave between lateral eyes; lateral edges of body with two pairs of well developed humps; ventral shield $942\mu\text{m}$ ($898\mu\text{m}$ - $988\mu\text{m}$) in length, $796\mu\text{m}$ ($790\mu\text{m}$ - $836\mu\text{m}$) in width; acetabular plates $562\mu\text{m}$ ($547\mu\text{m}$ - $578\mu\text{m}$) in width; gonopore $133\mu\text{m}$ ($135\mu\text{m}$ - $144\mu\text{m}$) in length, $130\mu\text{m}$ ($118\mu\text{m}$ - $133\mu\text{m}$) in width; genital valves with pigmented areas as shown in figure 558; dorsal lengths of the palpal segments: P-I, $32\mu\text{m}$ ($31\mu\text{m}$ - $34\mu\text{m}$); P-II, $74\mu\text{m}$ ($69\mu\text{m}$ - $76\mu\text{m}$); P-III, $64\mu\text{m}$ ($62\mu\text{m}$ - $66\mu\text{m}$); P-IV, $97\mu\text{m}$ ($87\mu\text{m}$ - $95\mu\text{m}$); P-V, $50\mu\text{m}$ ($48\mu\text{m}$ - $52\mu\text{m}$); figure 553 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4, $148\mu\text{m}$ ($148\mu\text{m}$ - $150\mu\text{m}$); I-Leg-5, $144\mu\text{m}$ ($137\mu\text{m}$ - $141\mu\text{m}$); I-Leg-6, $177\mu\text{m}$ ($173\mu\text{m}$ - $177\mu\text{m}$); figure 560 illustrates these segments; swimming hairs present on second, third and

fourth legs.

Holotype: Adult ♂, from Lake Ianthe, on Rt 6 between Pukekura and Evans Creek, South Island, Nov. 9, 1982.

Allotype: Adult ♀, same data as holotype.

Paratypes: 3 ♂, 5 ♀, same data as holotype.

Discussion: The present species is related to two members of the typical subgenus described by Stout (1953b). However, the much longer petiole and the more projecting pygal lobes in the male of the present species are diagnostic.

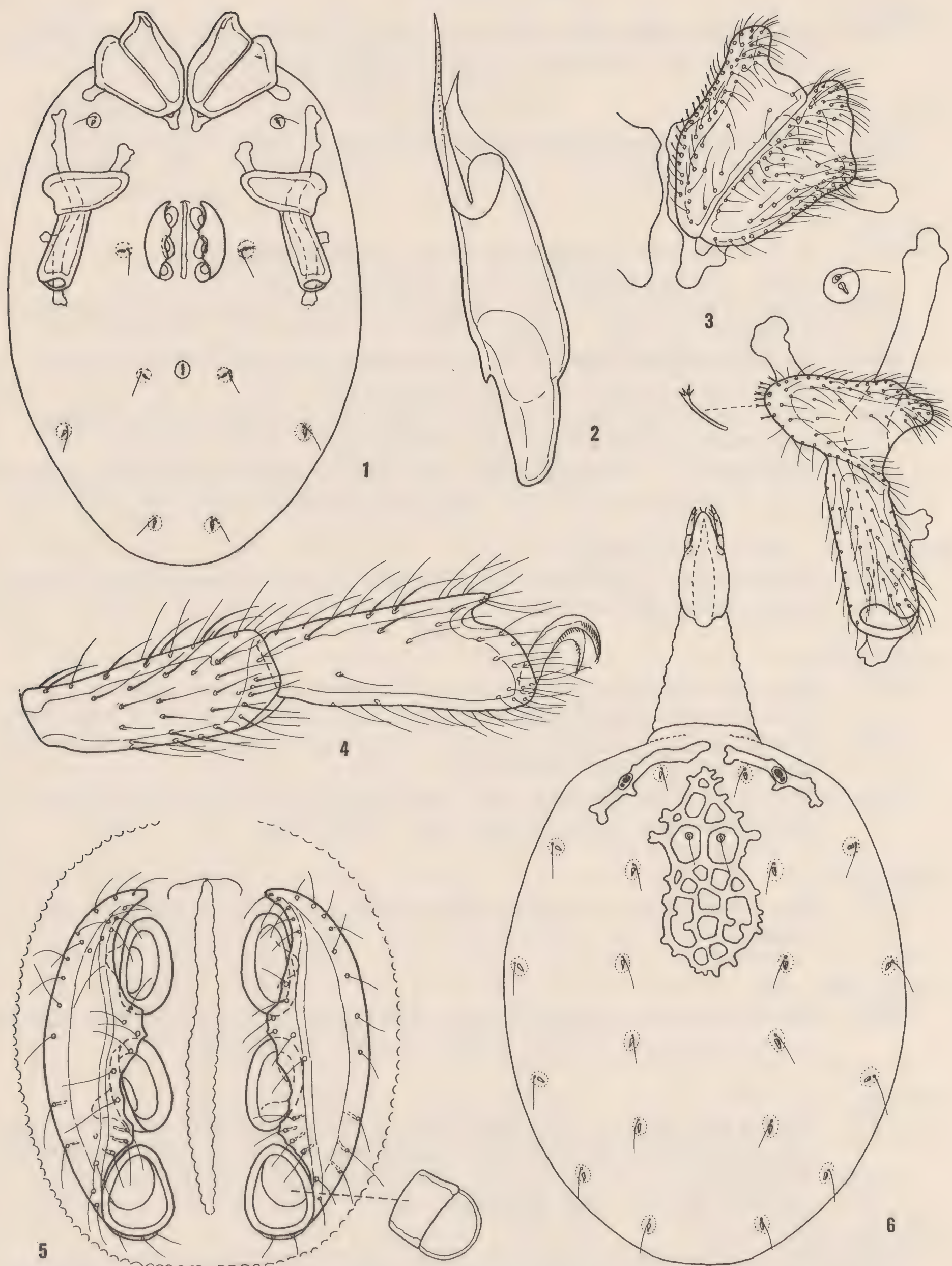
NEW ZEALAND HYPORHEIC WATER MITES

It was not possible to employ the classic Karaman-Chappuis method for collecting hyporheic (= interstitial) water mites in a majority of the New Zealand streams. Possibly as the result of a relatively constant rainfall throughout most of the year which keeps the streams from becoming low, and the fact there is a tendency for most of the streams to cut straight down rather than meander, the exposed bars of loose sand and gravel needed for efficient sampling by the Karaman-Chappuis method tend to remain under water. Collecting was done by digging deeply into the submerged bars with a shovel, spreading the gravel out in the more superficial waters and catching the organic material (and included organisms) several feet downstream. Digging to this depth (12"-18") probably does not sample the interstitial waters from as great a depth as when a hole is dug in a gravel bar and the water bailed out, but is sufficiently deep to take a large number of hyporheic forms. The main problem with this technique is that it, of course, stirs up and captures hydrachnids from the more superficial waters at the same time. Therefore, it is necessary to arbitrarily decide which species are interstitial. Those forms exhibiting loss of integumental pigmentation and reduction or complete loss of eye pigment, so characteristic of the hyporheic mites, almost certainly are from this habitat. However, it is known from studies on interstitial mites from other parts of the world in which collecting in exposed gravel bars is easier, that mites taken from the holes via the Karaman-Chappuis method often contain species in which integumental pigment and eye pigment are only slightly reduced. It is likely these species are in the process of adapting to the interstitial water environment. These intermediates present a problem in recognition when one collects in the submerged gravel bars and it is certain the list of interstitial species given below omits a number of these borderline forms, for only those with obvious eye and integumental pigmentation loss are included. The number in parentheses following the species name is the one used for that species in the text.

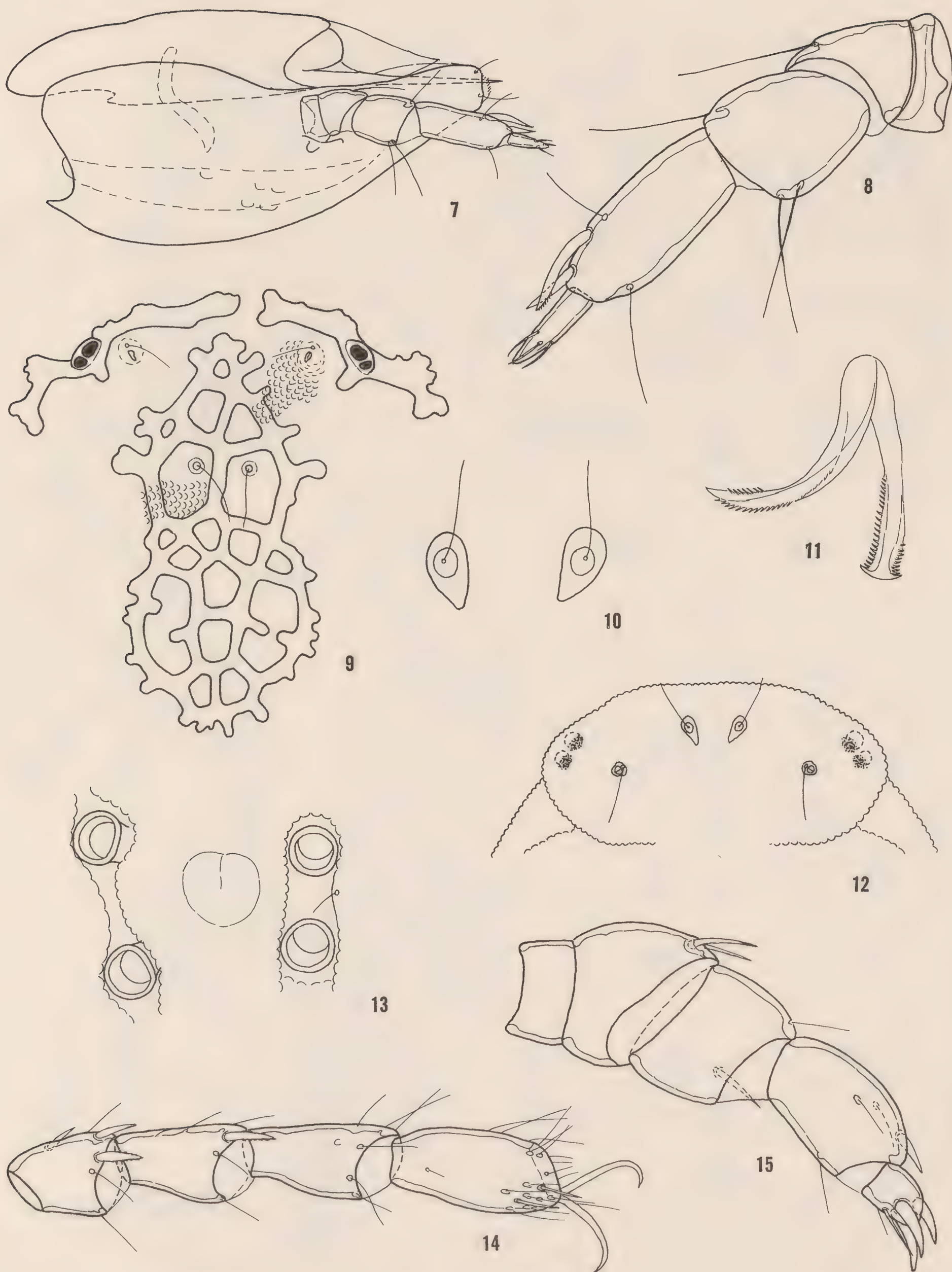
NEW ZEALAND HYPORHEIC MITES: *Euwandesia tenebrio* (2); *Limnesia birgelda* (22); *L. testacea* (23); *L. halcarda* (24); *L. crowelli* (25); *Notohygrobates kathrynae* (30); *Hopkinsobates suzannae* (31); *Aciculacarus amilis* (34); *Planaturus setipalpis* (40); *P. lundbladi* (41); *Taintaturus hopkinsi* (42); *T. accidens* (43); *T. abditus* (44); *T. projectus* (45); *Abelaturus cornophorus* (46); *Omegaturus longipalpis* (47); *Neotryssaturus pallidus* (55); *Pseudotryssaturus anchistus* (57); *P. planus* (58); *Evidaturus exilis* (63); *E. scopticus* (64); *Piotaturus alvecaudatus* (65); *P. bovalus* (66); *Paratryssaturus minutus* (68); *P. zodelus* (69); *Uralbia gracilipes* (79); *U. parva* (80); *U. projecta* (81); *Zelandalbia imamurai* (82); *Neomomoniea torquipes* (83); *N. hopkinsi* (84); *N. benova* (85); *N. paramecia* (86); *Partidomomoniea polyplacophora* (87); *Austramideopsoides serratifalpis* (90); *A. ramsayi* (91); *Arremurus zelandicus* (92).

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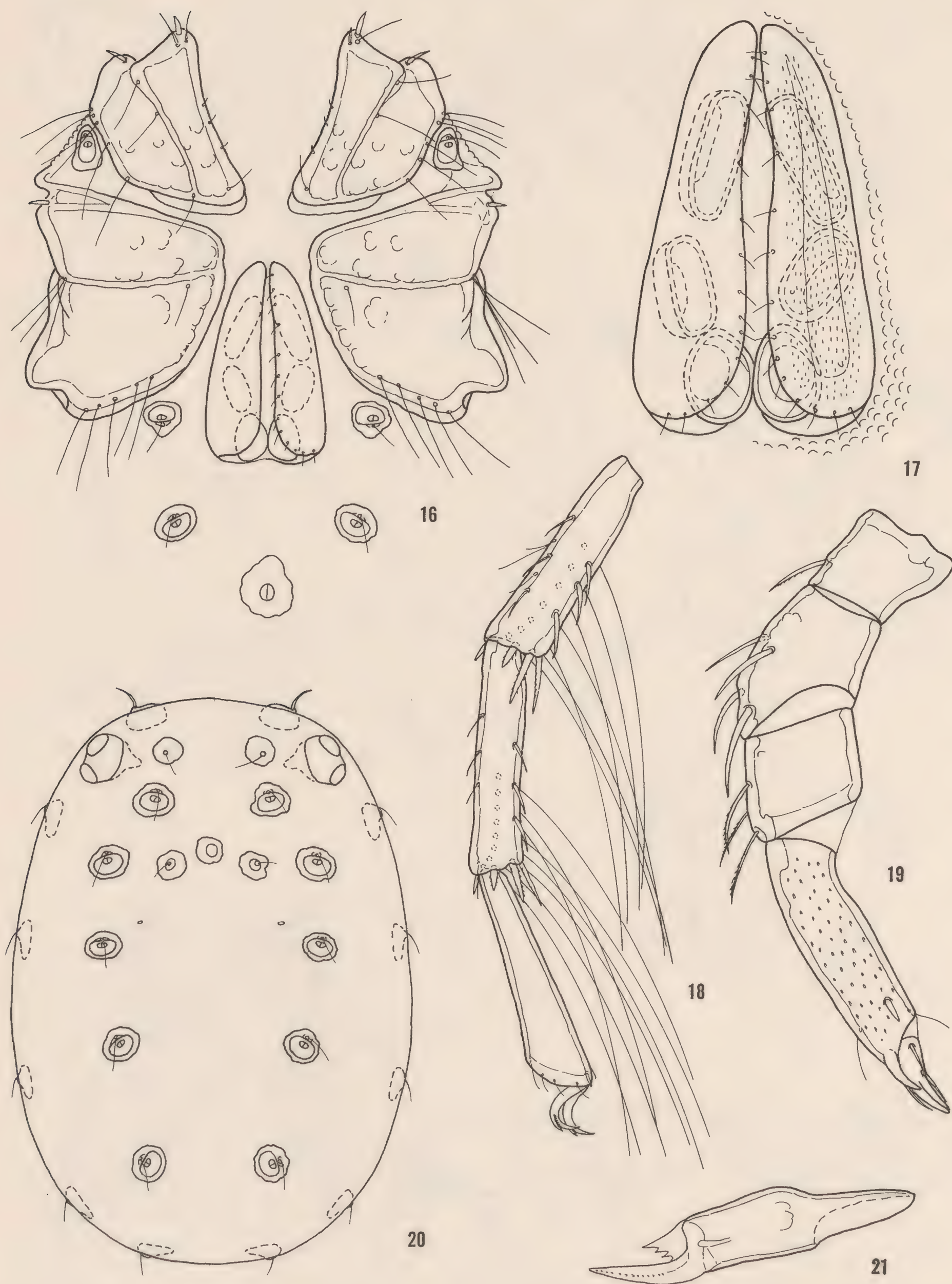
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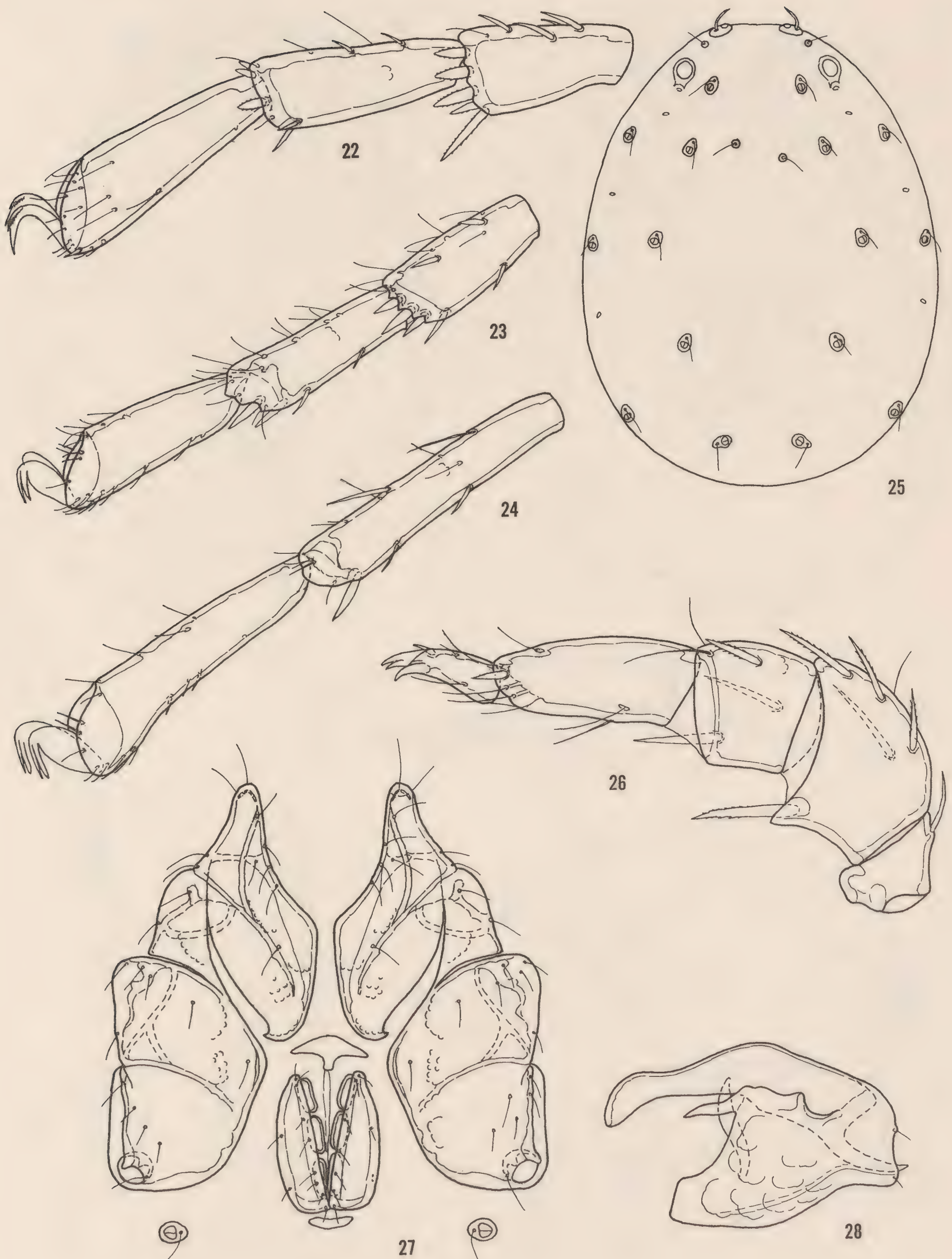
Zelandothyas diamphida n. sp. (Female) Fig. 1, ventral view; Fig. 2, chelicera; Fig. 3, coxal area; Fig. 4, I-Leg-5 and 6; Fig. 5, genital field; Fig. 6, dorsal view.



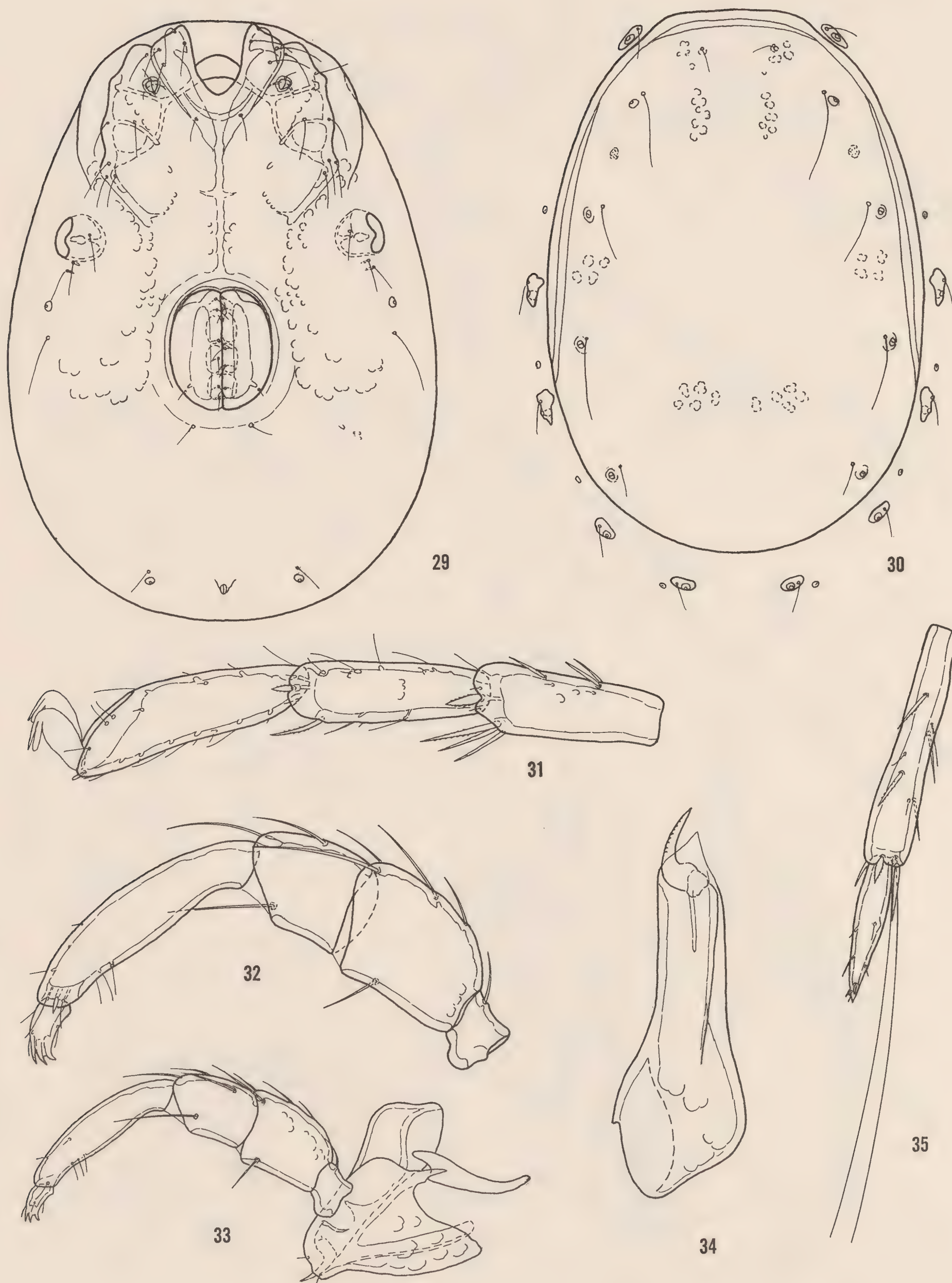
Zelandothyas diamphida n. sp. (Female) Fig. 7, lateral view of capitulum, chelicera and palp; Fig. 8, palp; Fig. 9, anterodorsal sclerites; Fig. 11, claws. *Euwandesia tenebrio* Hopkins and Schminke (Nymph) Fig. 10, postocularia platelets; Fig. 12, anterodorsal view; Fig. 13, provisional genital field; Fig. 14, distal segments of first leg; Fig. 15 palp.



Pseudohydryphantes bebelus n. sp. (Female) Fig. 16, ventral view; Fig. 17, genital field; Fig. 18, distal segments of fourth leg; Fig. 19, palp; Fig. 20, dorsal view; Fig. 21, chelicera.



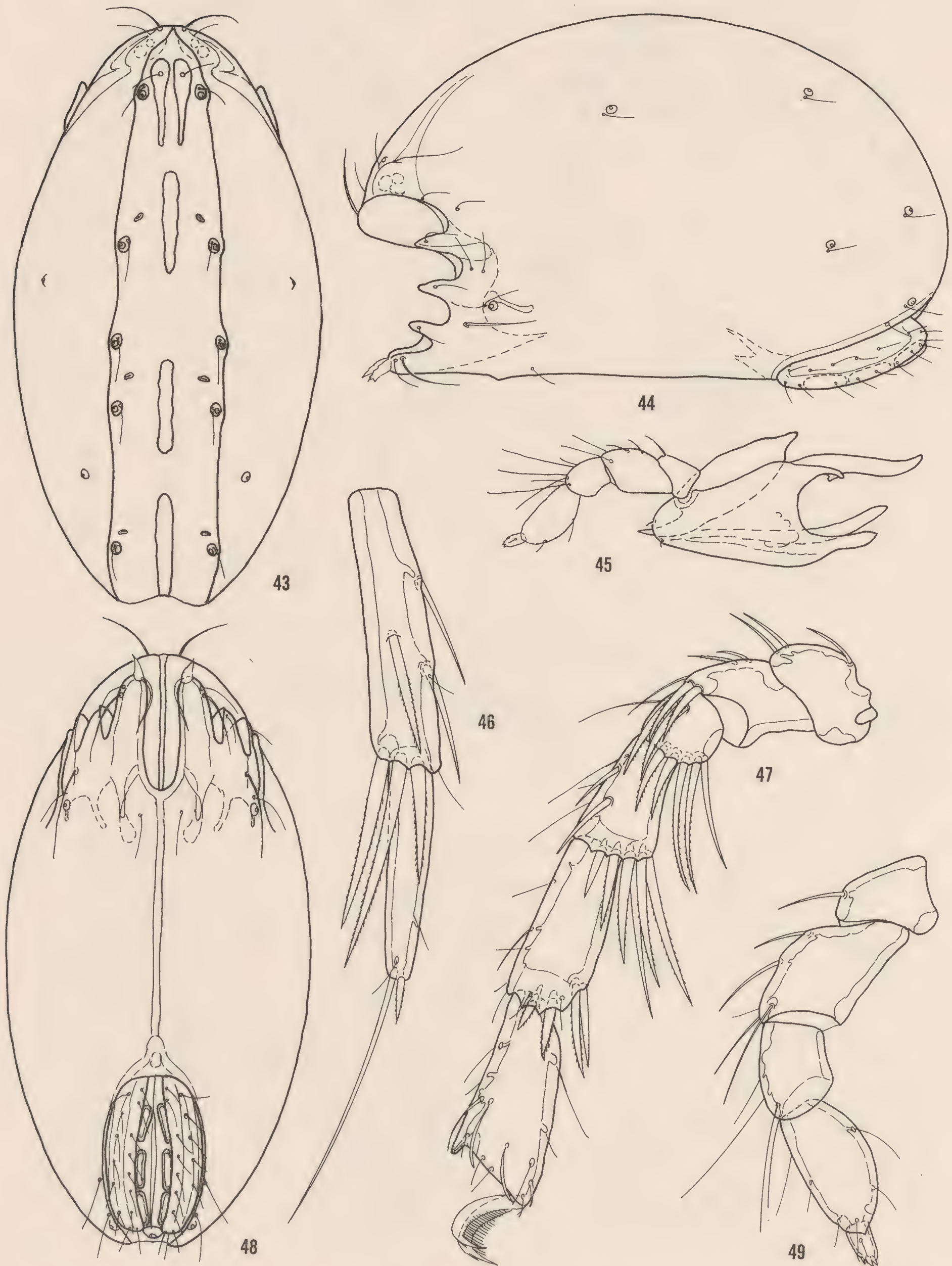
Pseudohydryphantes bebelus n. sp. Fig. 22, distal segments of first leg, ♀.
Apeltosperchon zelandicus n. sp. (Female) Fig. 23, distal segments of first leg; Fig. 24, IV-Leg-5 and 6; Fig. 25, dorsal view; Fig. 26, palp; Fig. 27, ventral sclerites; Fig. 28, lateral view of capitulum and chelicera.



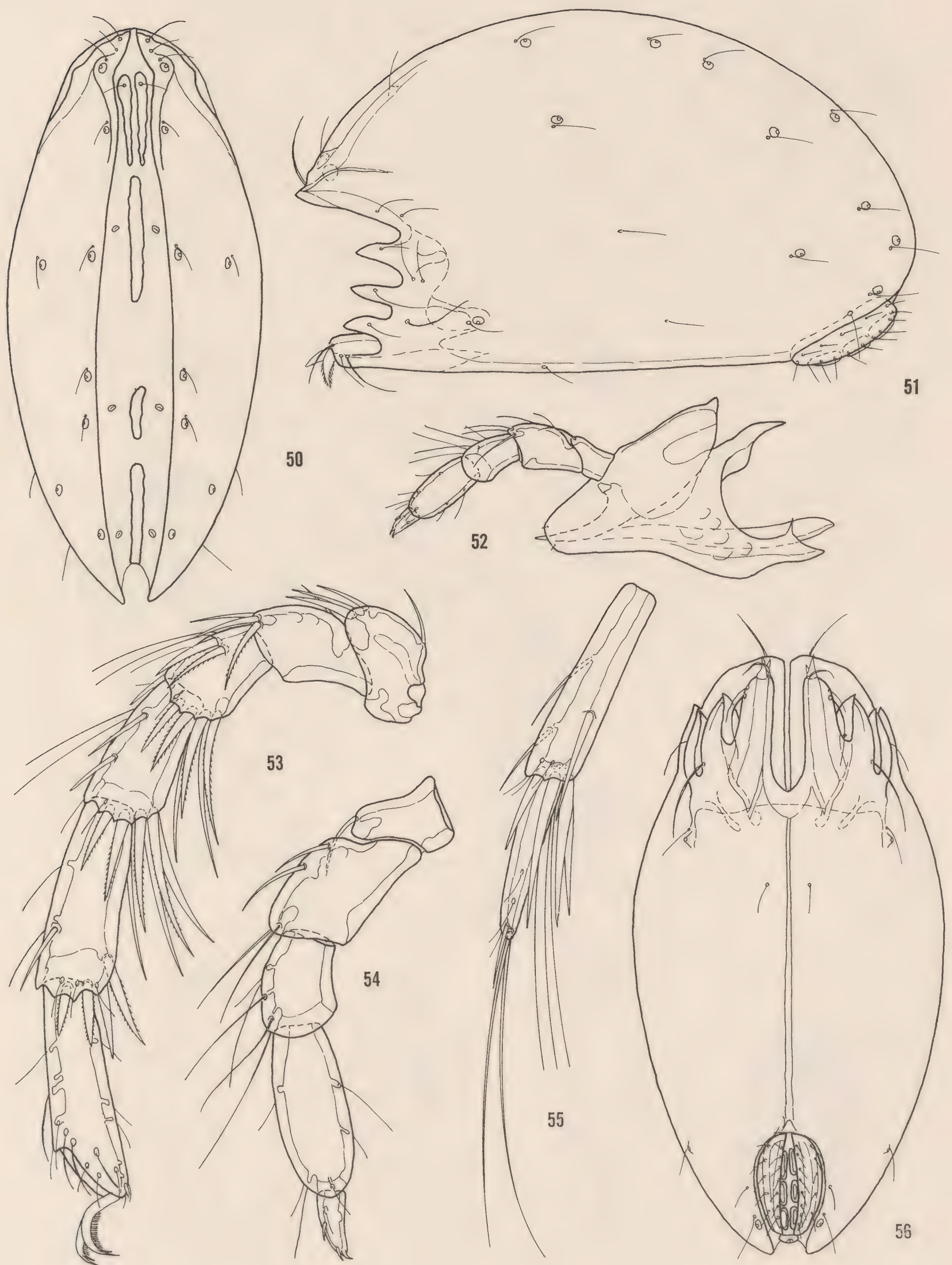
Anisitsiellides arraphus n. sp. (Female) Fig. 29, ventral shield; Fig. 30, dorsal shield; Fig. 31, distal segments of first leg; Fig. 32, palp; Fig. 33, lateral view of capitulum, chelicera and palp; Fig. 34, chelicera; Fig. 35, IV-Leg-5 and 6.



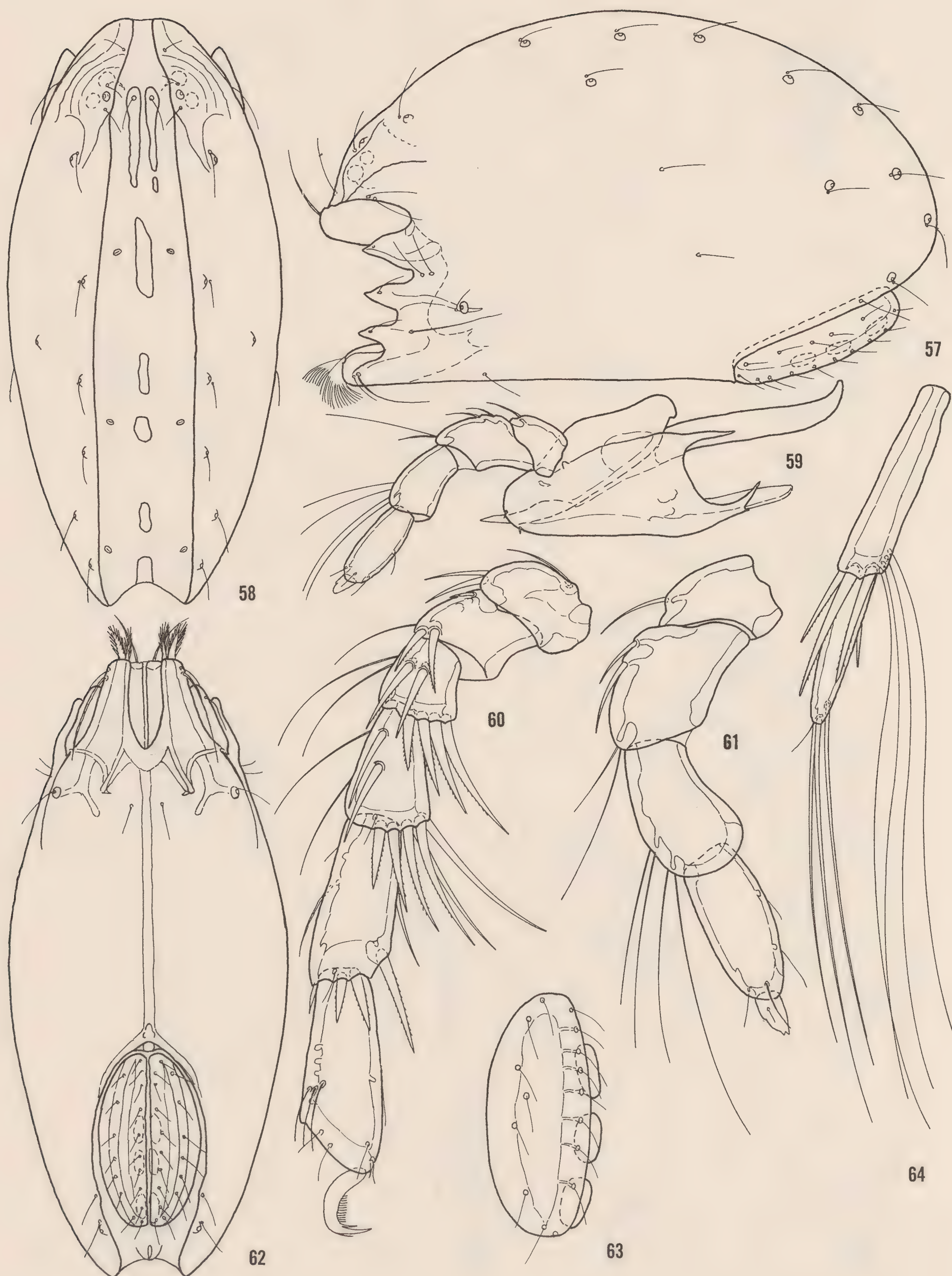
Anisitsiellides partitus n. sp. (Female) Fig. 36, ventral shield; Fig. 37, dorsal shield; Fig. 38, IV-Leg-5 and 6; Fig. 39, chelicera; Fig. 40, lateral view of capitulum, chelicera and palp; Fig. 41, palp; Fig. 42, distal segments of the first leg.



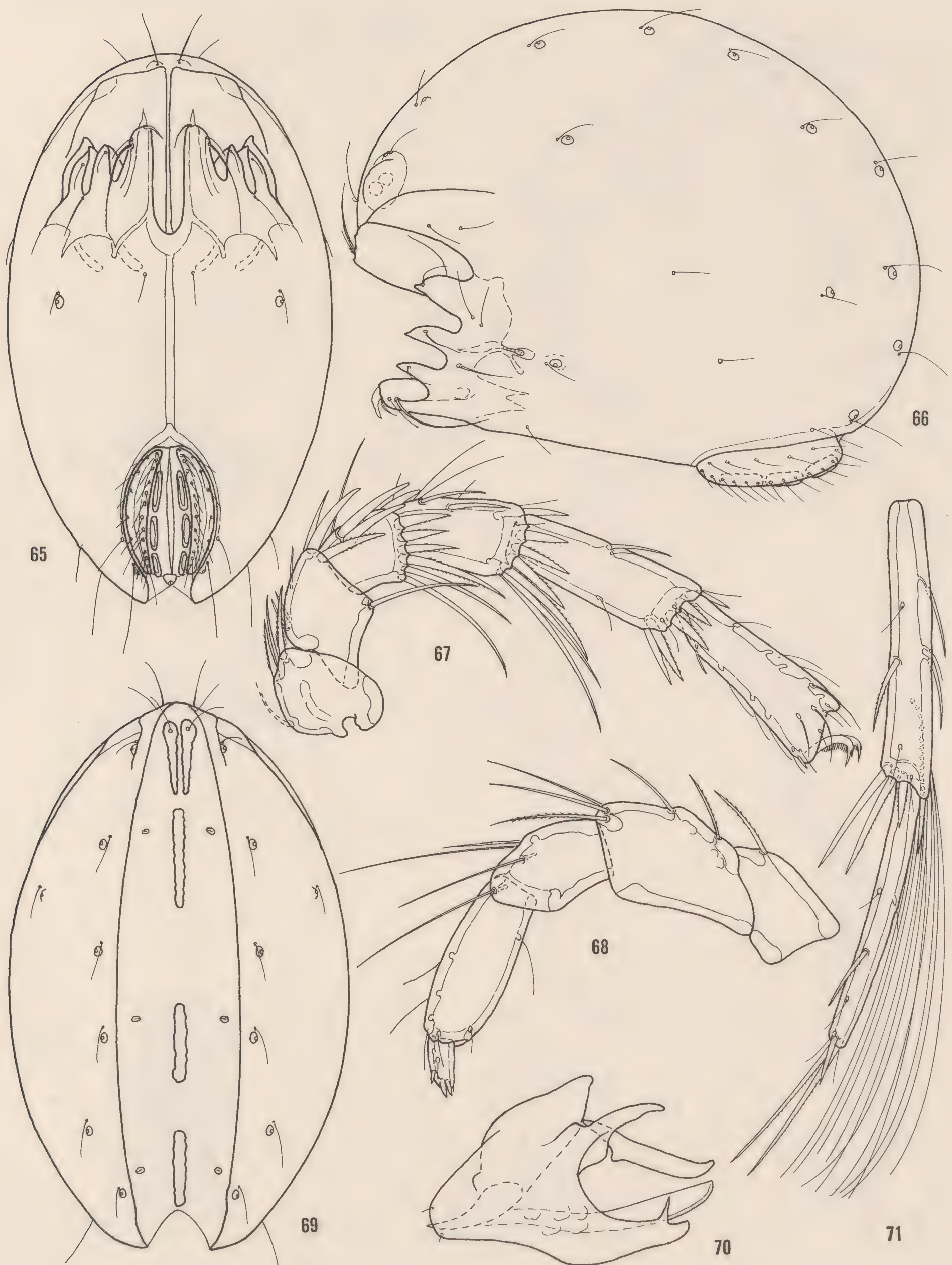
Flabellifrontipoda smithi n. sp. (Female) Fig. 43, dorsal view; Fig. 44, lateral view; Fig. 45, lateral view of capitulum, chelicera and palp; Fig. 46, IV-Leg-5 and 6; Fig. 47, first leg; Fig. 48, ventral view; Fig. 49, palp.



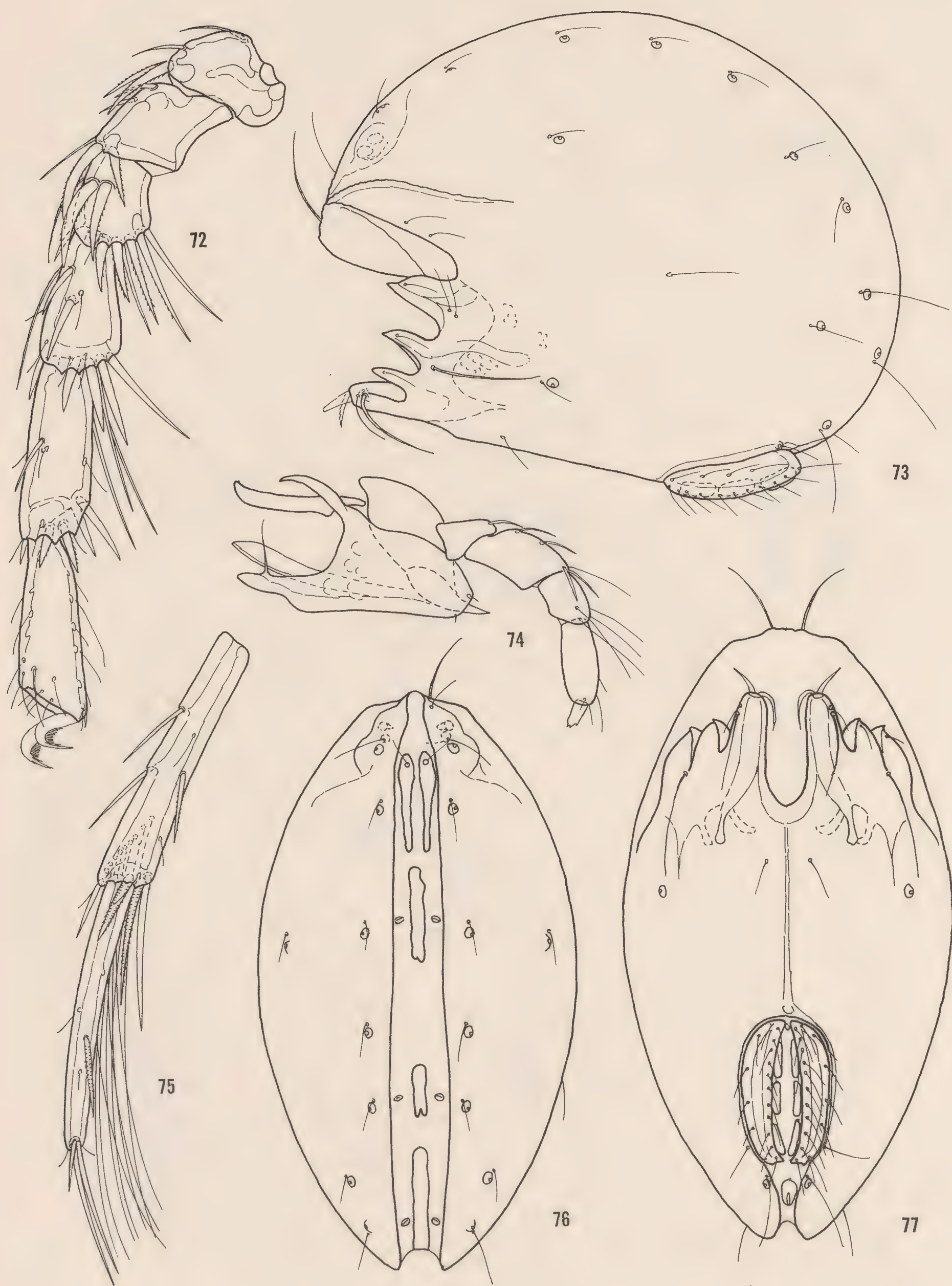
Flabellifrontipoda hadinoma n. sp. (Male) Fig. 50, dorsal view; Fig. 51, lateral view; Fig. 52, lateral view of capitulum, chelicera and palp; Fig. 53, first leg; Fig. 54, palp; Fig. 55, IV-Leg-5 and 6; Fig. 56, ventral view.



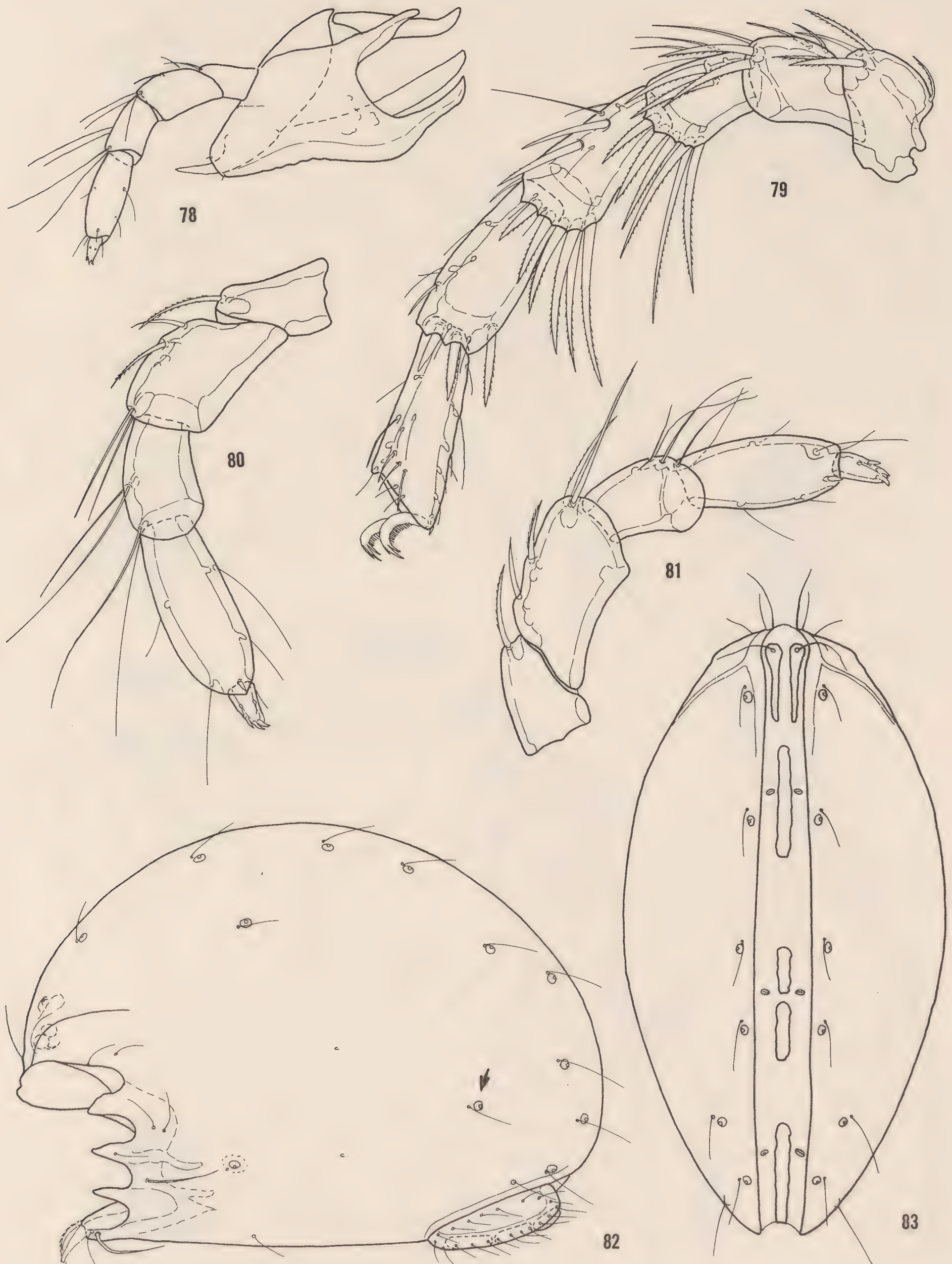
Flabellifrontipoda mastigophora n. sp. Fig. 57, lateral view, ♀; Fig. 58, dorsal view, ♀; Fig. 59, lateral view of capitulum, chelicera and palp, ♂; Fig. 60, first leg, ♀; Fig. 61, palp, ♀; Fig. 62, ventral view, ♀; Fig. 63, genital flaps, ♂; Fig. 64, IV-Leg-5 and 6, ♀.



Flabellifrontipoda lacustris n. sp. (Female) Fig. 65, ventral view; Fig. 66, lateral view; Fig. 67, first leg; Fig. 68, palp; Fig. 69, dorsal view; Fig. 70, lateral view of capitulum and chelicera; Fig. 71, IV-Leg-5 and 6.

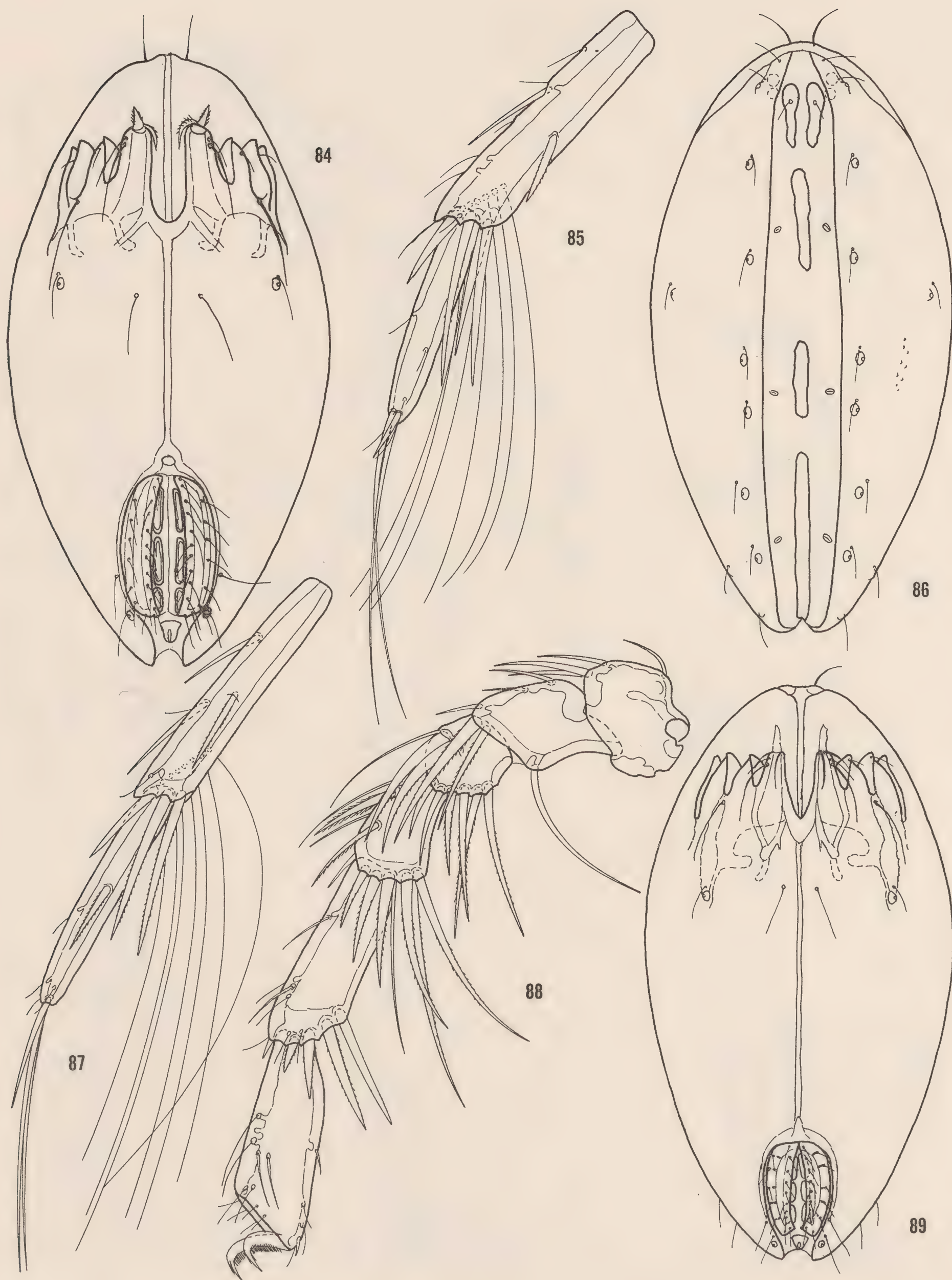


Flabellifrontipoda bravana n. sp. Fig. 72, first leg, ♂; Fig. 73, lateral view, ♂; Fig. 74, lateral view of capitulum, chelicera and palp, ♂; Fig. 75, IV-Leg-5 and 6, ♂; Fig. 76, dorsal view, ♀; Fig. 77, ventral view, ♀.



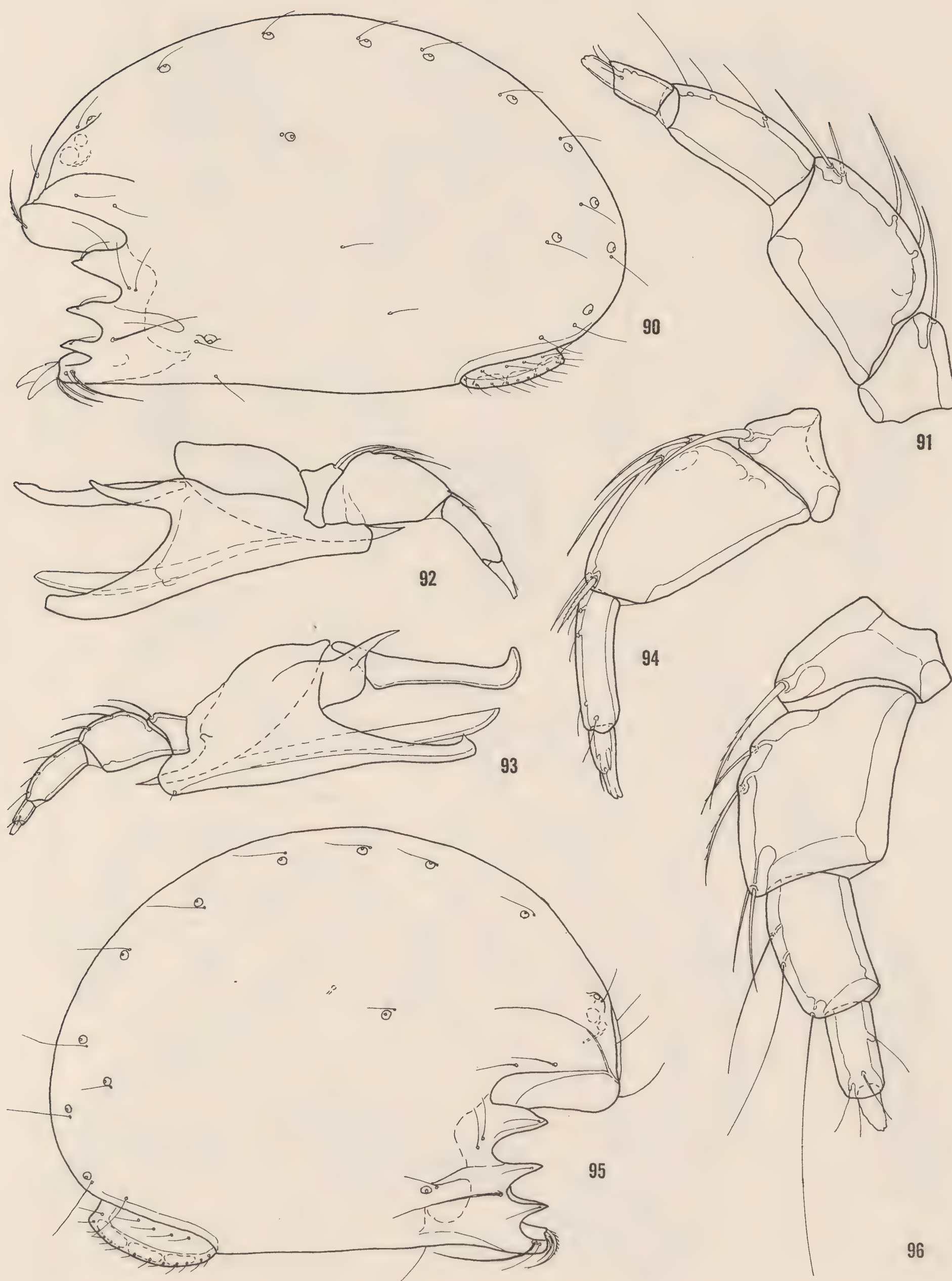
Flabellifrontipoda zelandica Hopkins (Female) Fig. 78, lateral view of capitulum, chelicera and palp; Fig. 79, first leg; Fig. 80, palp; Fig. 82, lateral view; Fig. 83, dorsal view.

Flabellifrontipoda bravana n. sp. Fig. 81, palp, ♂.



Flabellifrontipoda zelandica Hopkins Fig. 84, ventral view, ♀; Fig. 85, IV-Leg-5 and 6, ♀.

Flabellifrontipoda ladilofa n. sp. (Male) Fig. 86, dorsal view; Fig. 87, IV-Leg-5 and 6; Fig. 88, first leg; Fig. 89, ventral view.

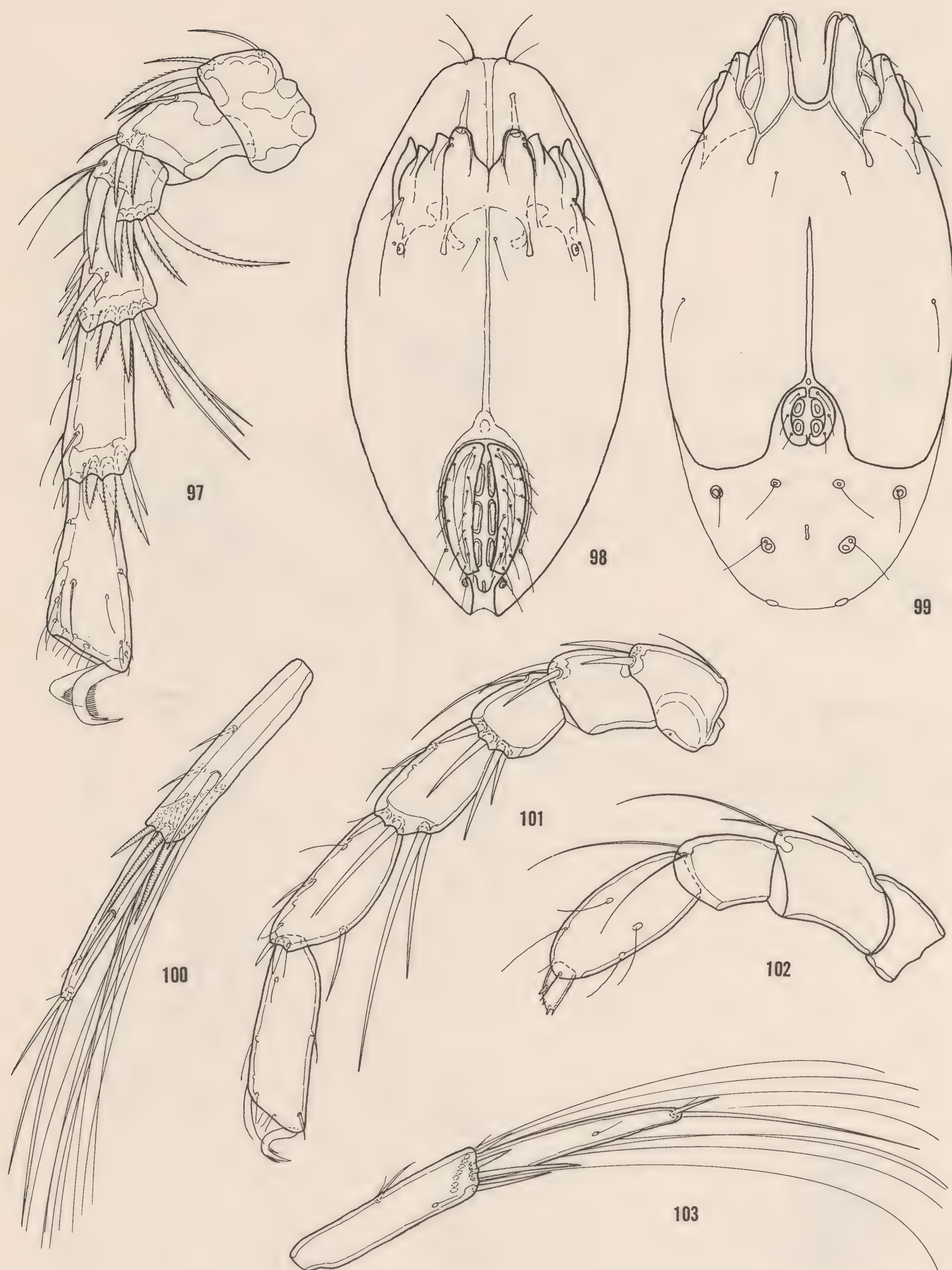


Flabellifrontipoda ladilofa n. sp. (Male) Fig. 90, lateral view; Fig. 91, palp;

Fig. 93, lateral view of capitulum, chelicera and palp,

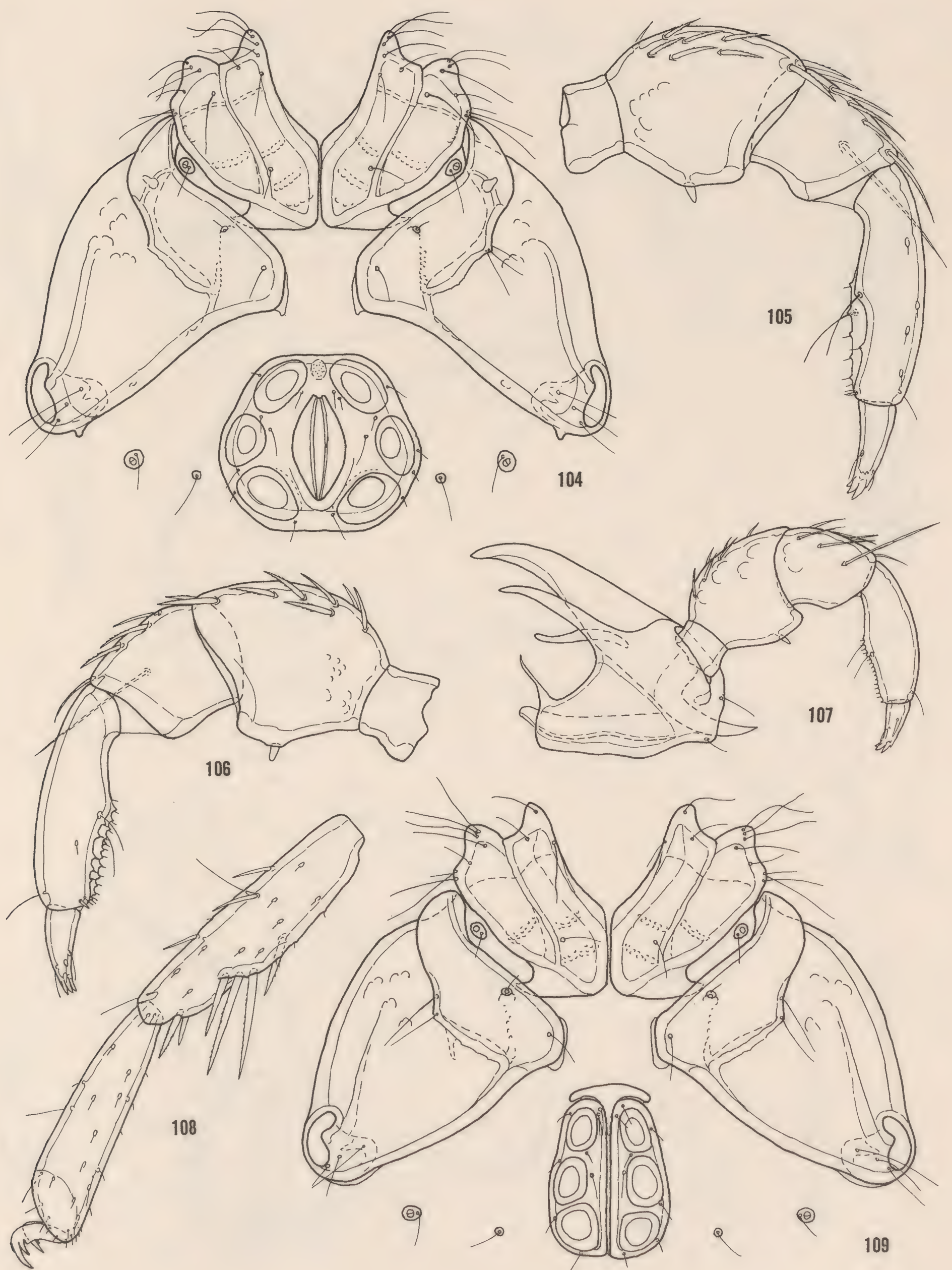
Flabellifrontipoda reductipalpa n. sp. (Female) Fig. 92, lateral view of capitulum, chelicera and palp; Fig. 94, palp; Fig. 95, lateral view.

Flabellifrontipoda crameri n. sp. Fig. 96, palp, ♂.

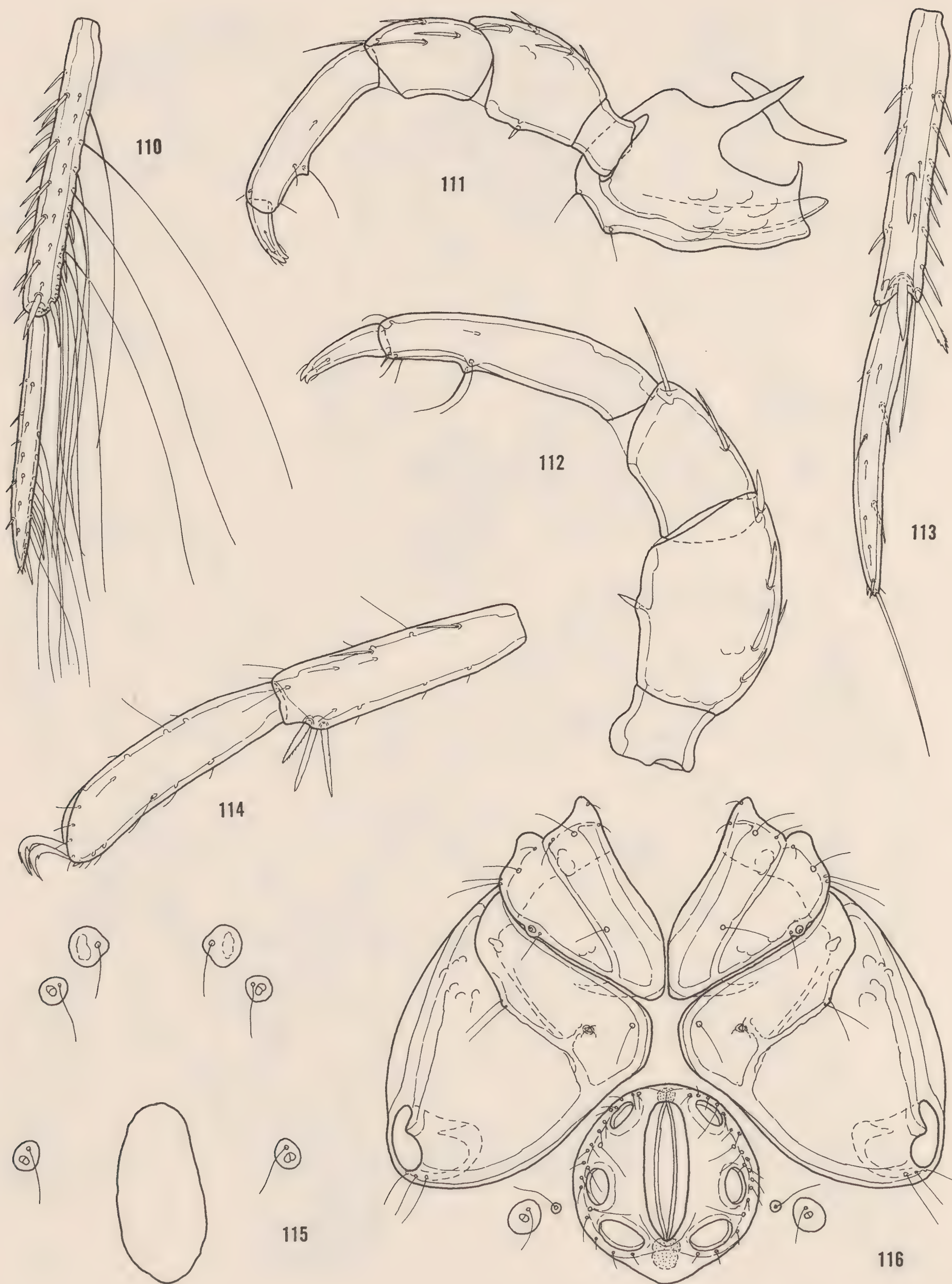


Flabellifrontipoda reductipalpa n. sp. (Female) Fig. 97, first leg; Fig. 98, ventral view; Fig. 100, IV-Leg-5 and 6.

Oxus sp. (Nymph) Fig. 99, ventral view; Fig. 101, first leg; Fig. 102, palp; Fig. 103, IV-Leg-5 and 6.

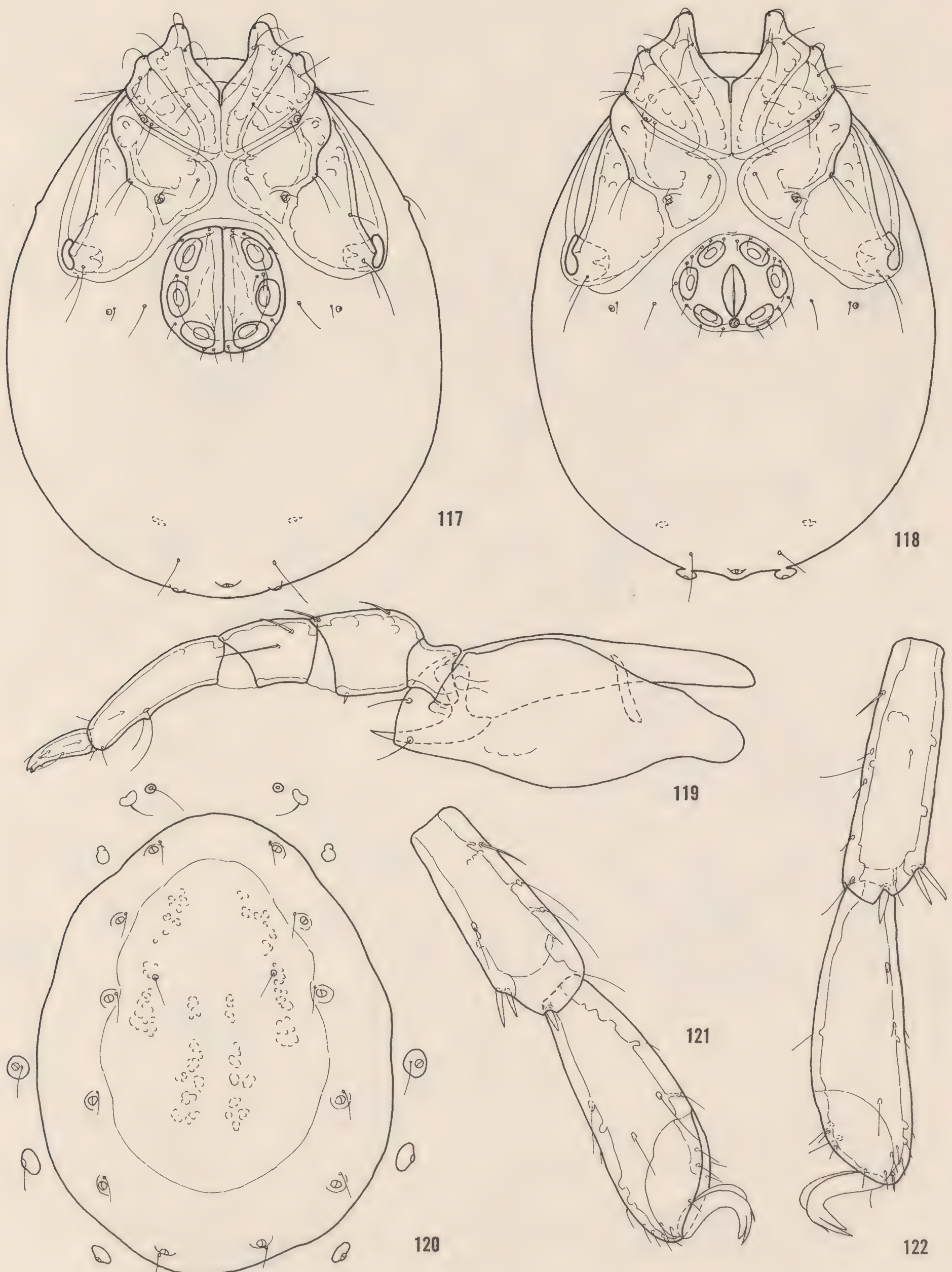


Limnesia foldoma n. sp. Fig. 104, ventral sclerites, ♂; Fig. 105, palp, ♀; Fig. 106, palp, ♂; Fig. 107, lateral view of capitulum, chelicera and palp, ♂; Fig. 108, I-Leg-5 and 6, ♀; Fig. 109, ventral sclerites, ♀.



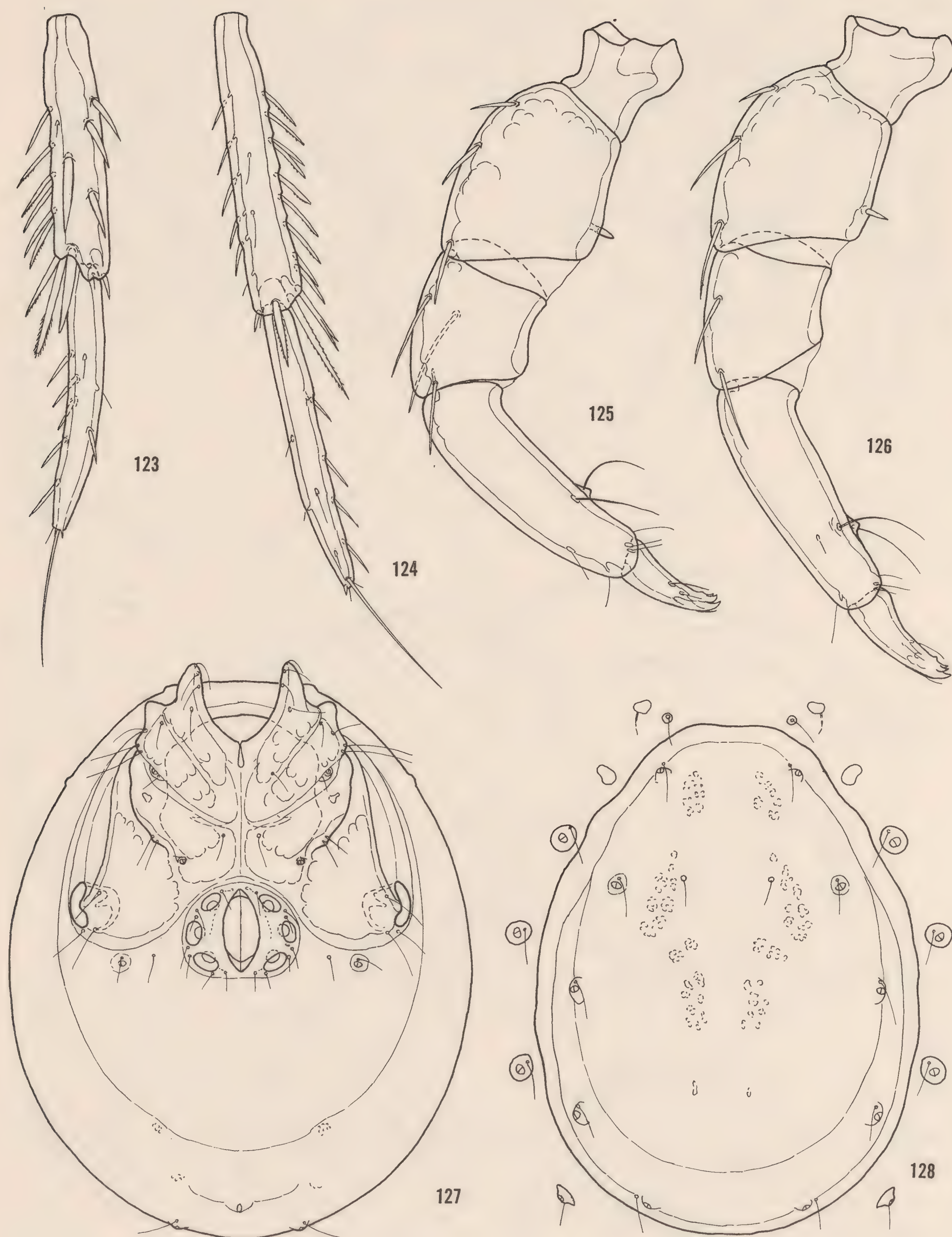
Limnesia foldoma n. sp. Fig. 110, IV-Leg-5 and 6, ♀.

Limnesia reptans Hopkins (Male) Fig. 111, lateral view of capitulum, chelicera and palp; Fig. 112, palp; Fig. 113, IV-Leg-5 and 6; Fig. 114, I-Leg-5 and 6; Fig. 115, dorsal platelet; Fig. 116, ventral sclerites.



Limnesia zelandica n. sp. Fig. 117, ventral shield, ♀; Fig. 118, ventral shield, ♂; Fig. 119, lateral view of capitulum, chelicera and palp, ♂; Fig. 120, dorsal shield, ♀; Fig. 122, I-Leg-5 and 6, ♂.

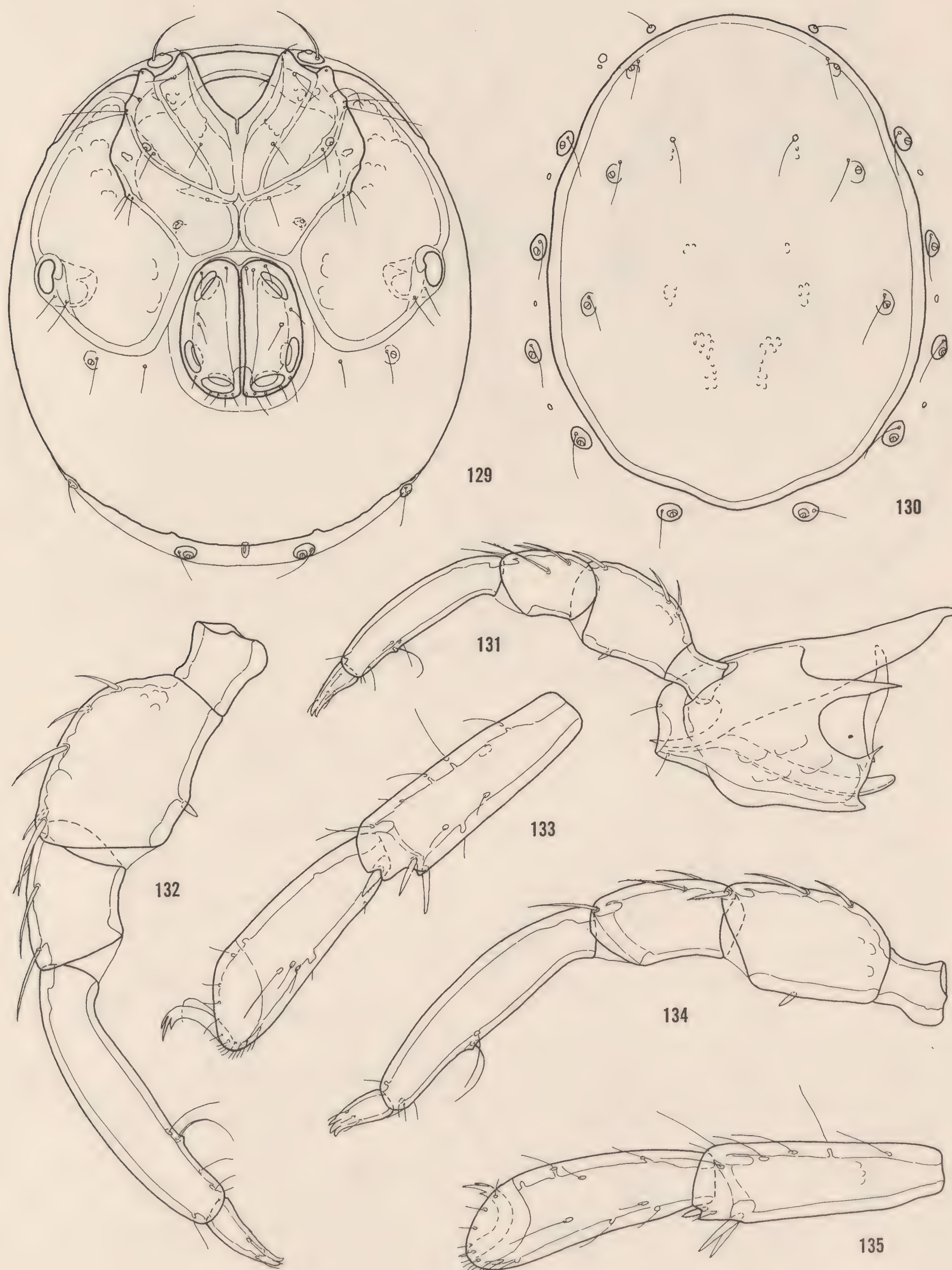
Limnesia conroyi n. sp. Fig. 121, I-Leg-5 and 6, ♂.



Limnesia conroyi n. sp. (Male) Fig. 123, IV-Leg-5 and 6; Fig. 125, palp; Fig. 127, ventral shield; Fig. 128, dorsal shield.

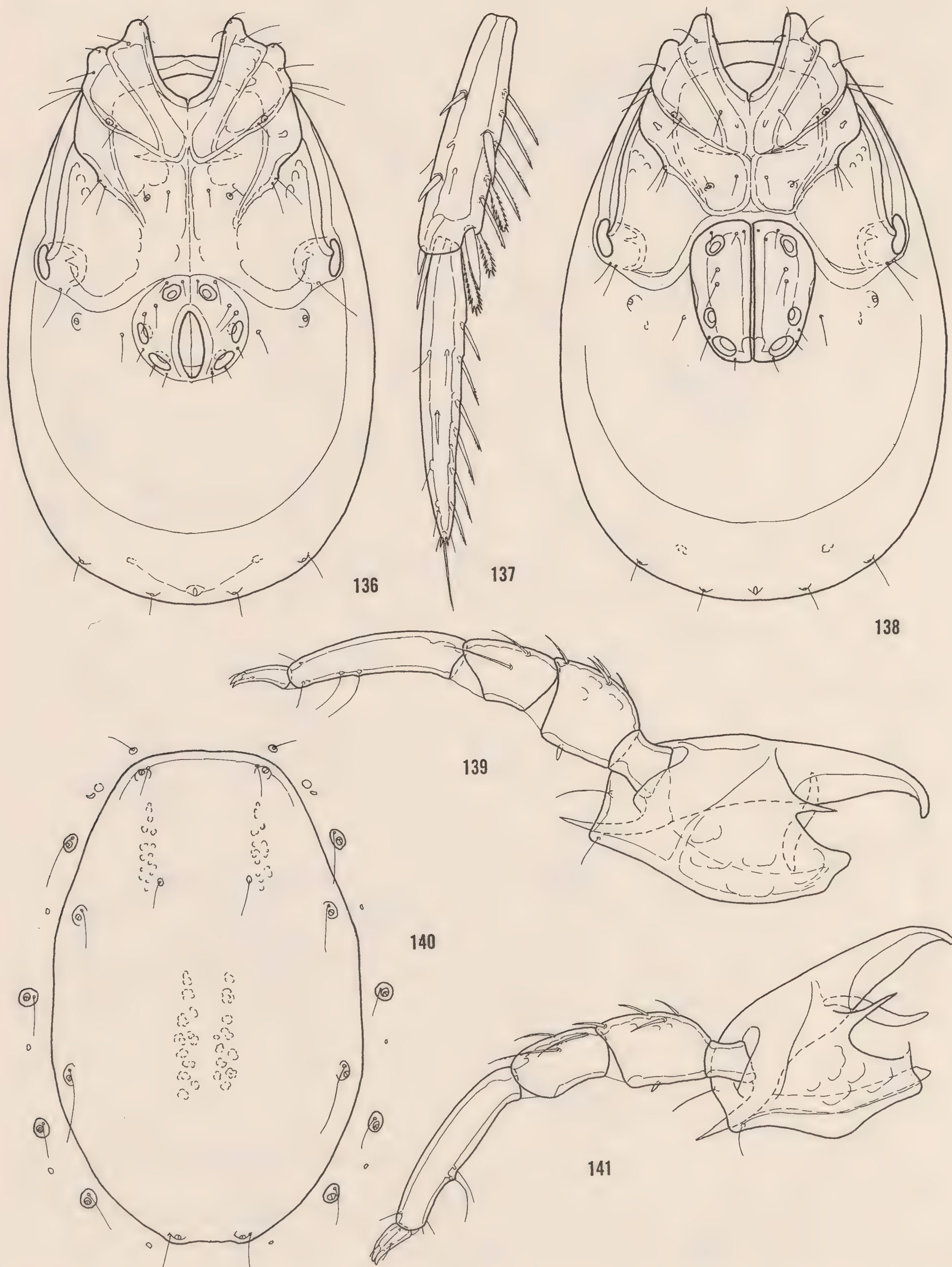
Limnesia auspexa n. sp. Fig. 124, IV-Leg-5 and 6, ♀.

Limnesia zelandica n. sp. Fig. 126, palp, ♀.



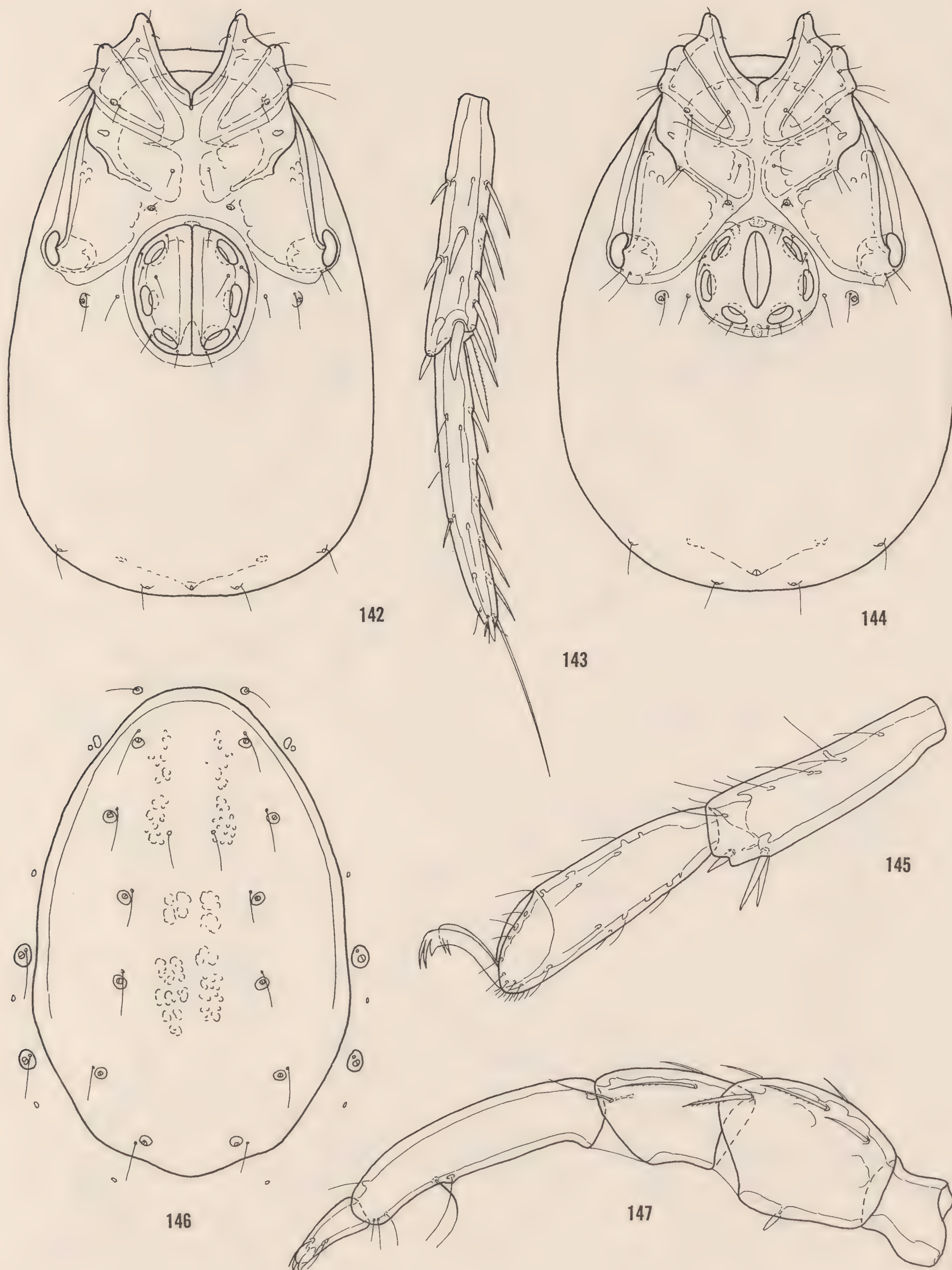
Limnesia auspexa n. sp. (Female) Fig. 129, ventral shield; Fig. 130, dorsal shield; Fig. 131, lateral view of capitulum, chelicera and palp; Fig. 132, palp; Fig. 133, I-Leg-5 and 6.

Limnesia birgelda n. sp. Fig. 134, palp, ♀; Fig. 135, I-Leg-5 and 6, ♀.

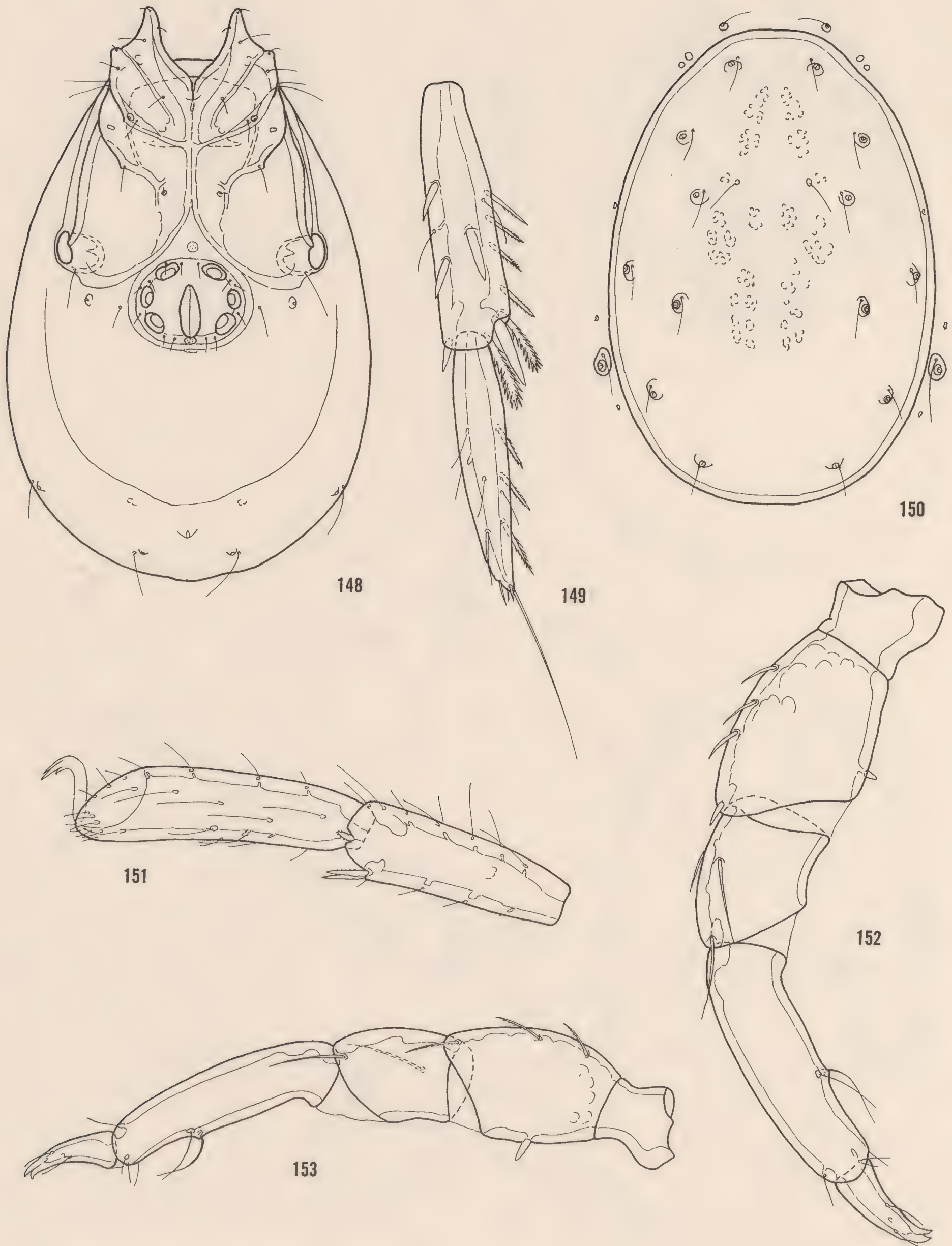


Limnesia birgelda n. sp. Fig. 136, ventral shield, ♂; Fig. 137, IV-Leg-5 and 6, ♀; Fig. 138, ventral shield, ♀; Fig. 140, dorsal shield, ♂; Fig. 141, lateral view of capitulum, chelicera and palp, ♀.

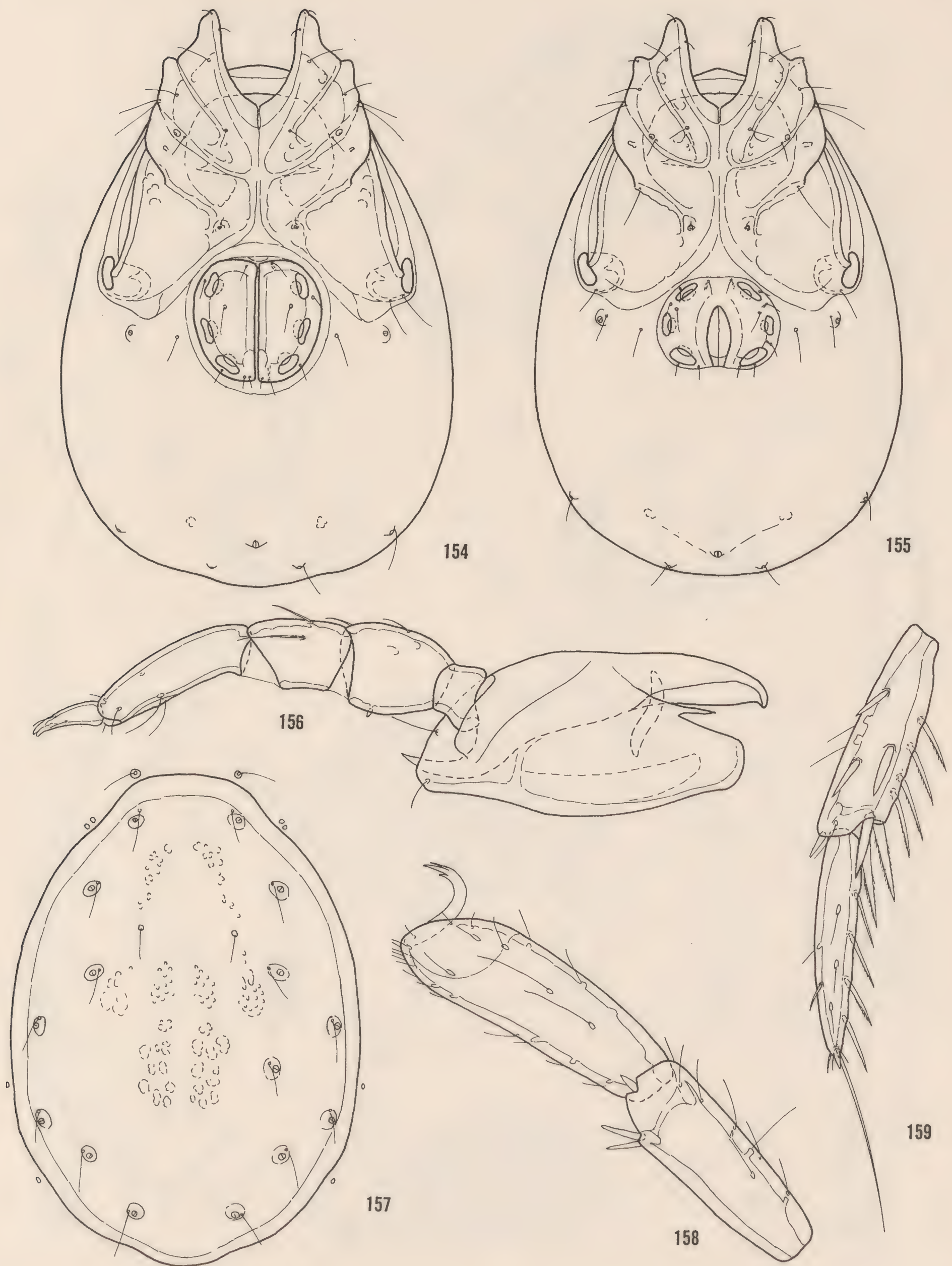
Limnesia testacea Hopkins Fig. 139, lateral view of capitulum, chelicera and palp, ♀.



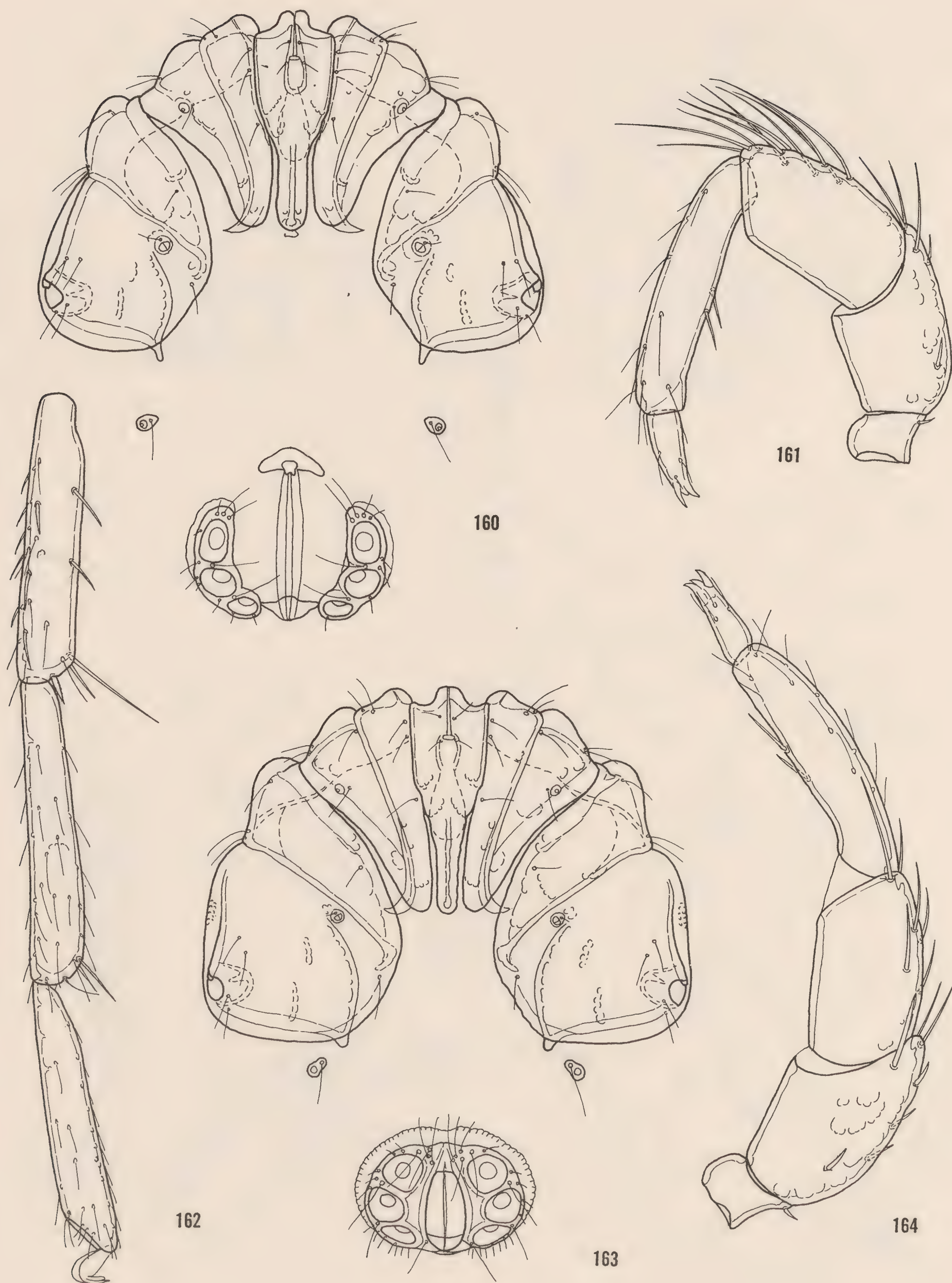
Limnesia testacea Hopkins Fig. 142, ventral shield, ♀; Fig. 143, IV-Leg-5 and 6, ♂; Fig. 144, ventral shield, ♂; Fig. 145, I-Leg-5 and 6, ♂; Fig. 146, dorsal shield, ♀; Fig. 147, palp, ♀.



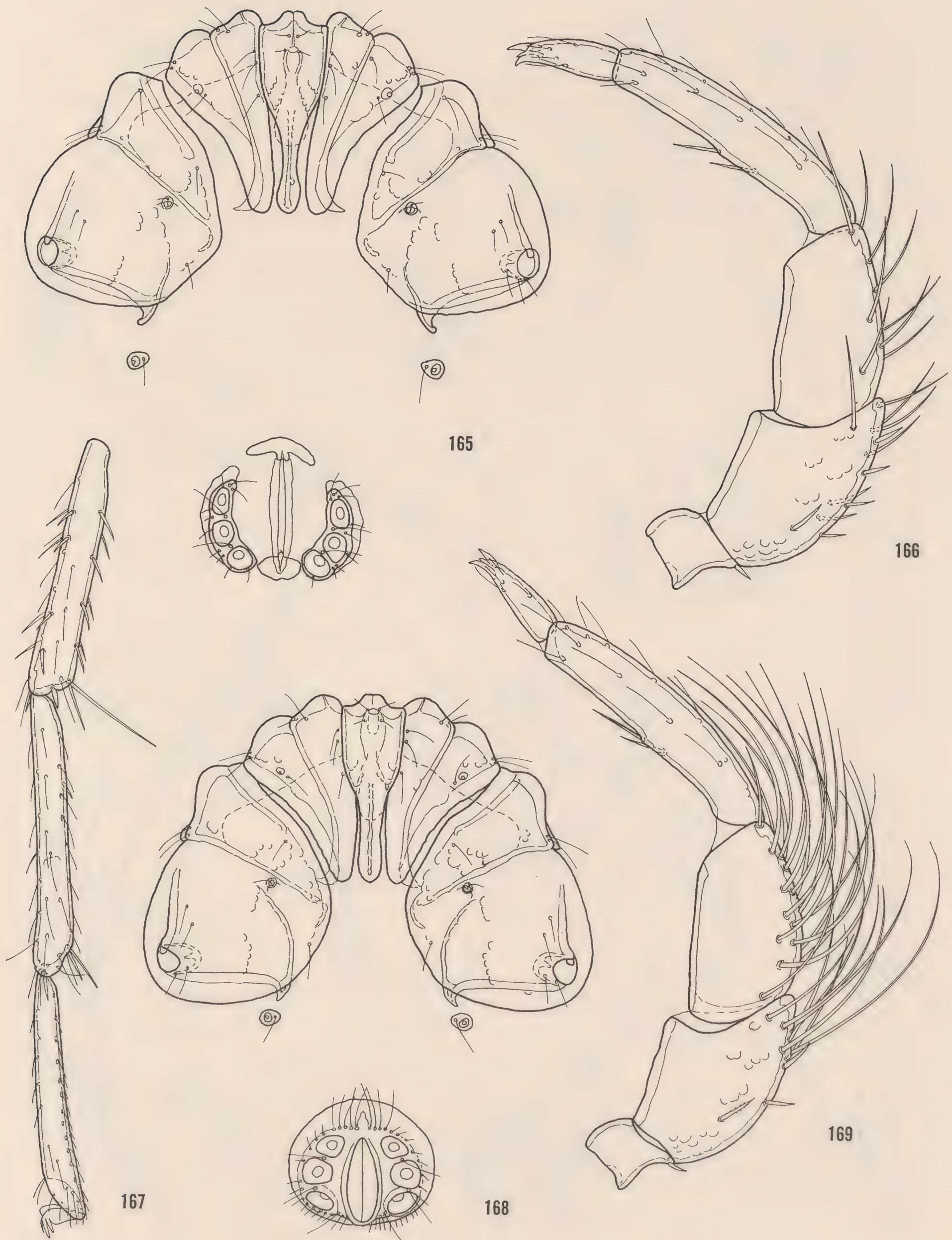
Limnesia halcarda n. sp. (Male) Fig. 148, ventral shield; Fig. 149, IV-Leg-5 and 6; Fig. 150, dorsal shield; Fig. 151, I-Leg-5 and 6; Fig. 153, palp.
Limnesia crowelli n. sp. Fig. 152, palp, ♀.



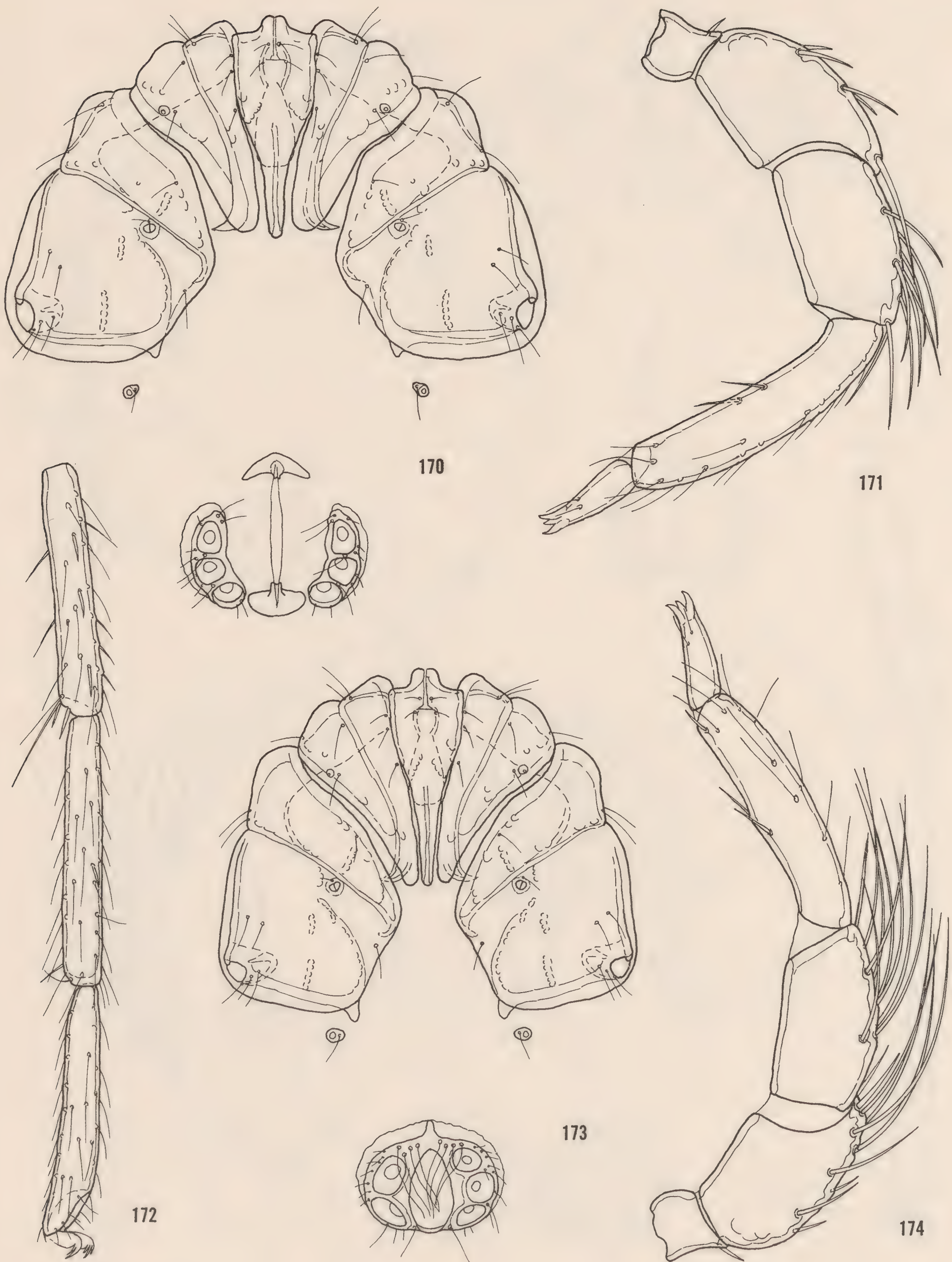
Limnesia crowelli n. sp. Fig. 154, ventral shield, ♀; Fig. 155, ventral shield, ♂; Fig. 156, lateral view of capitulum, chelicera and palp, ♀; Fig. 157, dorsal shield, ♀; Fig. 158, I-Leg-5 and 6, ♂; Fig. 159, IV-Leg-5 and 6, ♂.



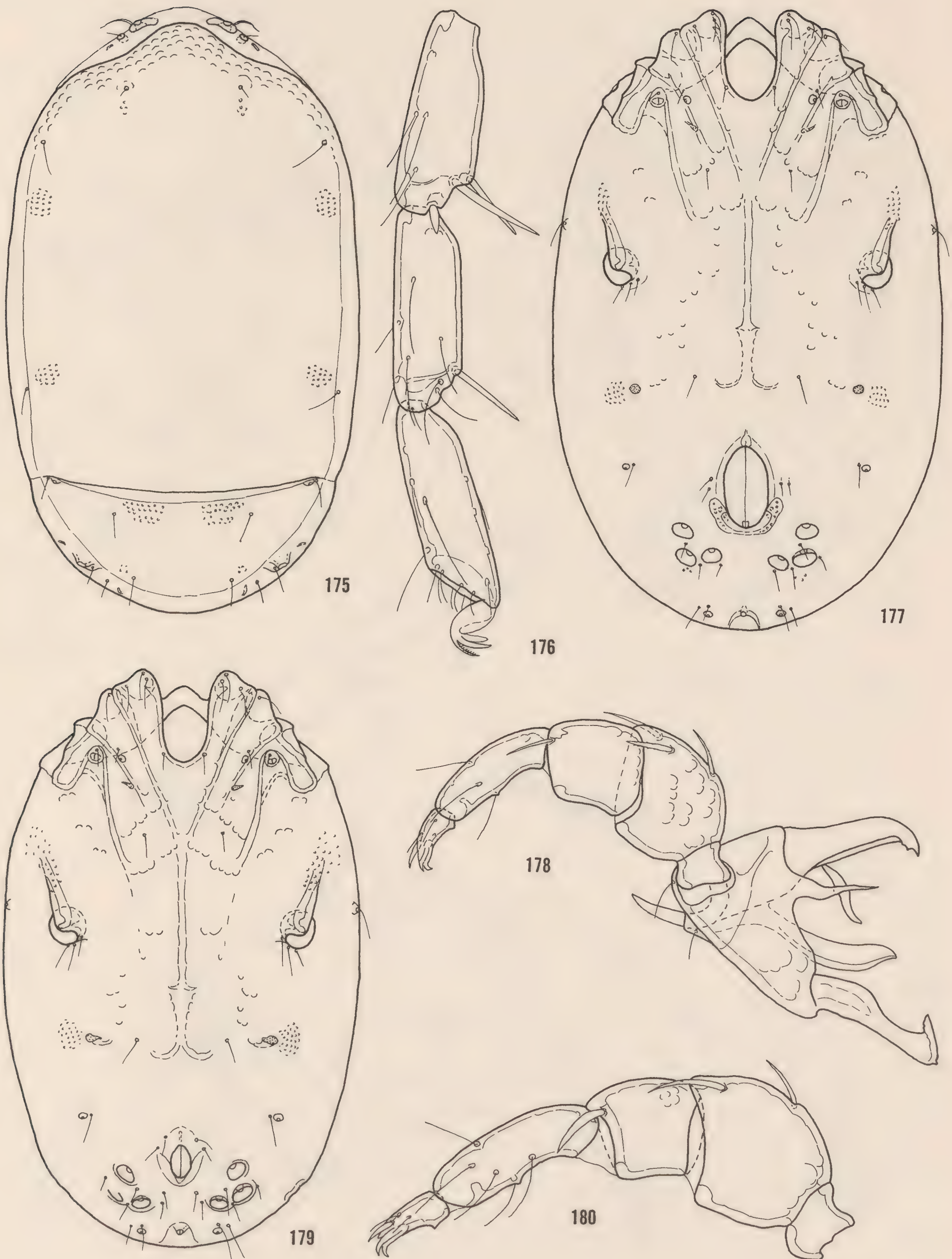
Australiobates vietsi n. sp. Fig. 160, ventral sclerites, ♀; Fig. 161, palp, ♂; Fig. 162, distal segments of first leg, ♀; Fig. 163, ventral sclerites, ♂; Fig. 164, palp, ♀.



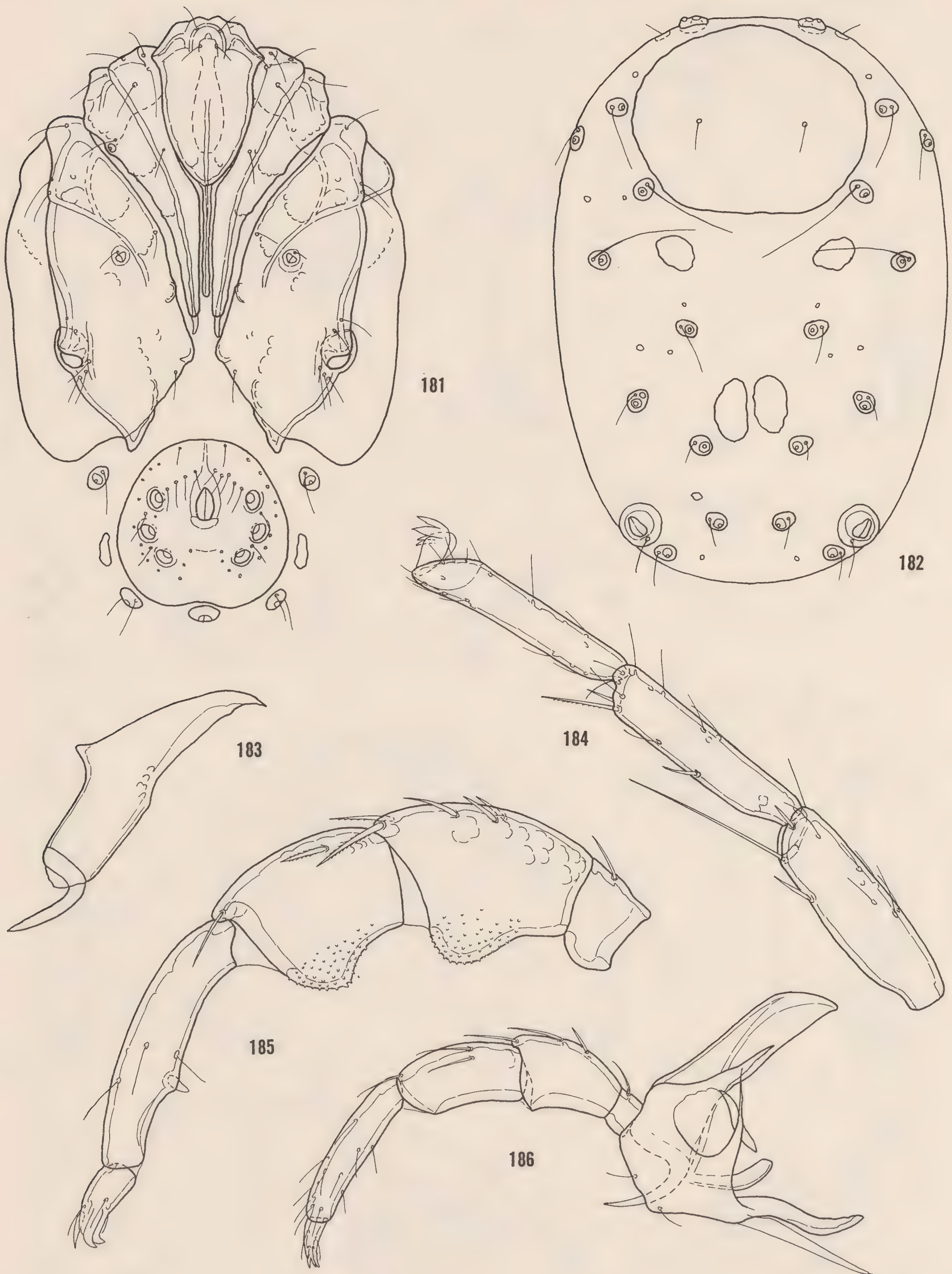
Australiobates setipalpis n. sp. Fig. 165, ventral sclerites, ♀; Fig. 166, palp, ♀; Fig. 167, distal segments of first leg, ♀; Fig. 168, ventral sclerites, ♂; Fig. 169, palp, ♂.



Australiobates solomis n. sp. Fig. 170, ventral view, ♀; Fig. 171, palp, ♀.
Australiobates savanus n. sp. (Male) Fig. 172, distal segments of first leg;
 Fig. 173, ventral view; Fig. 174, palp.

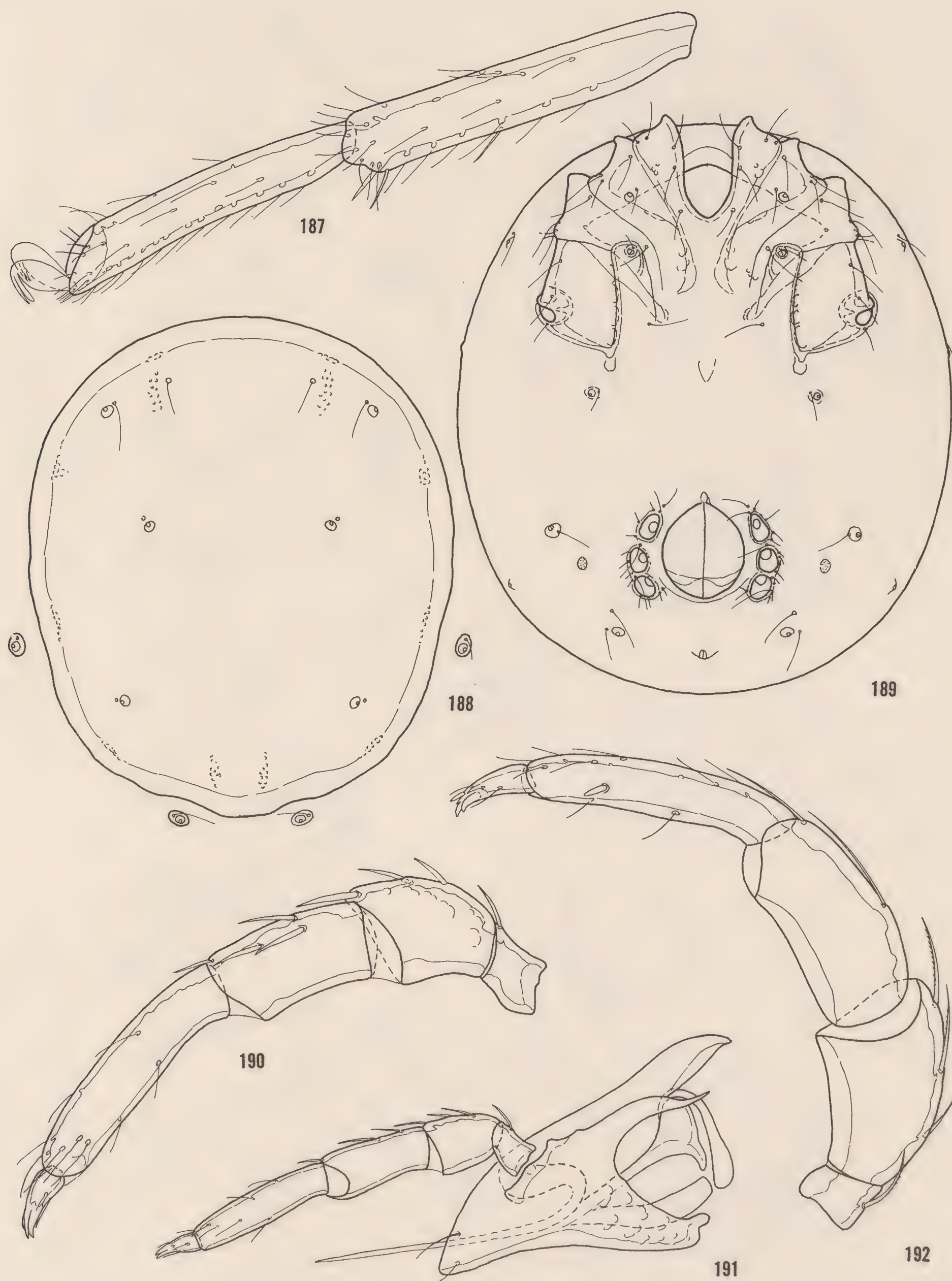


Hopkinsobates suzannae n. sp. Fig. 175, dorsal shield, ♀; Fig. 176, distal segments of first leg, ♀; Fig. 177, ventral shield, ♂; Fig. 178, lateral view of capitulum, chelicera and palp, ♀; Fig. 179, ventral shield, ♂; Fig. 180, palp, ♂.



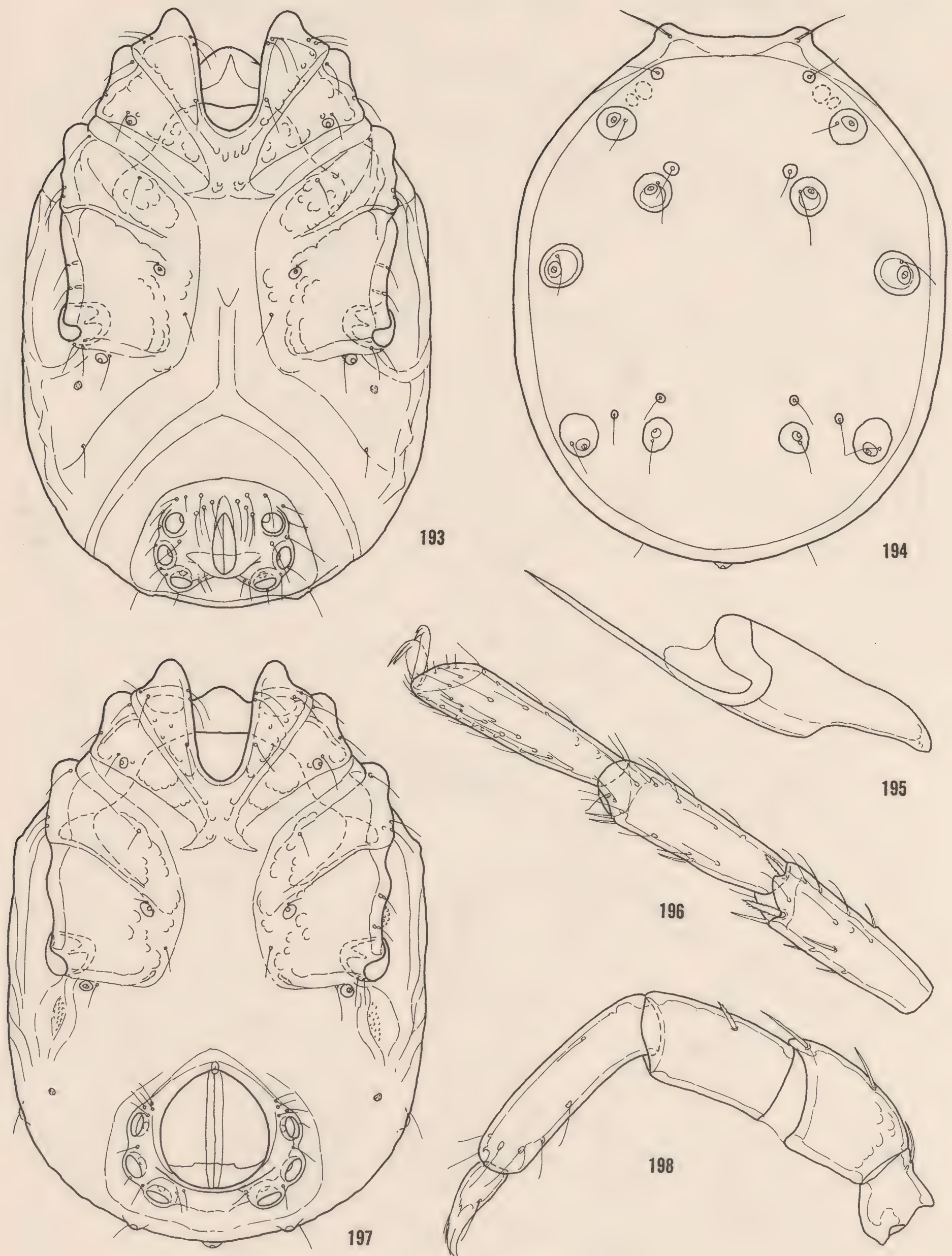
Notohygrobatas kathrynae n. sp. (Male) Fig. 181, ventral sclerites; Fig. 182, dorsal view; Fig. 183, chelicera; Fig. 184, distal segments of first leg; Fig. 185, palp.

Aspidiobates orbiculatus Hopkins Fig. 186, lateral view of capitulum, chelicera and palp, ♀.



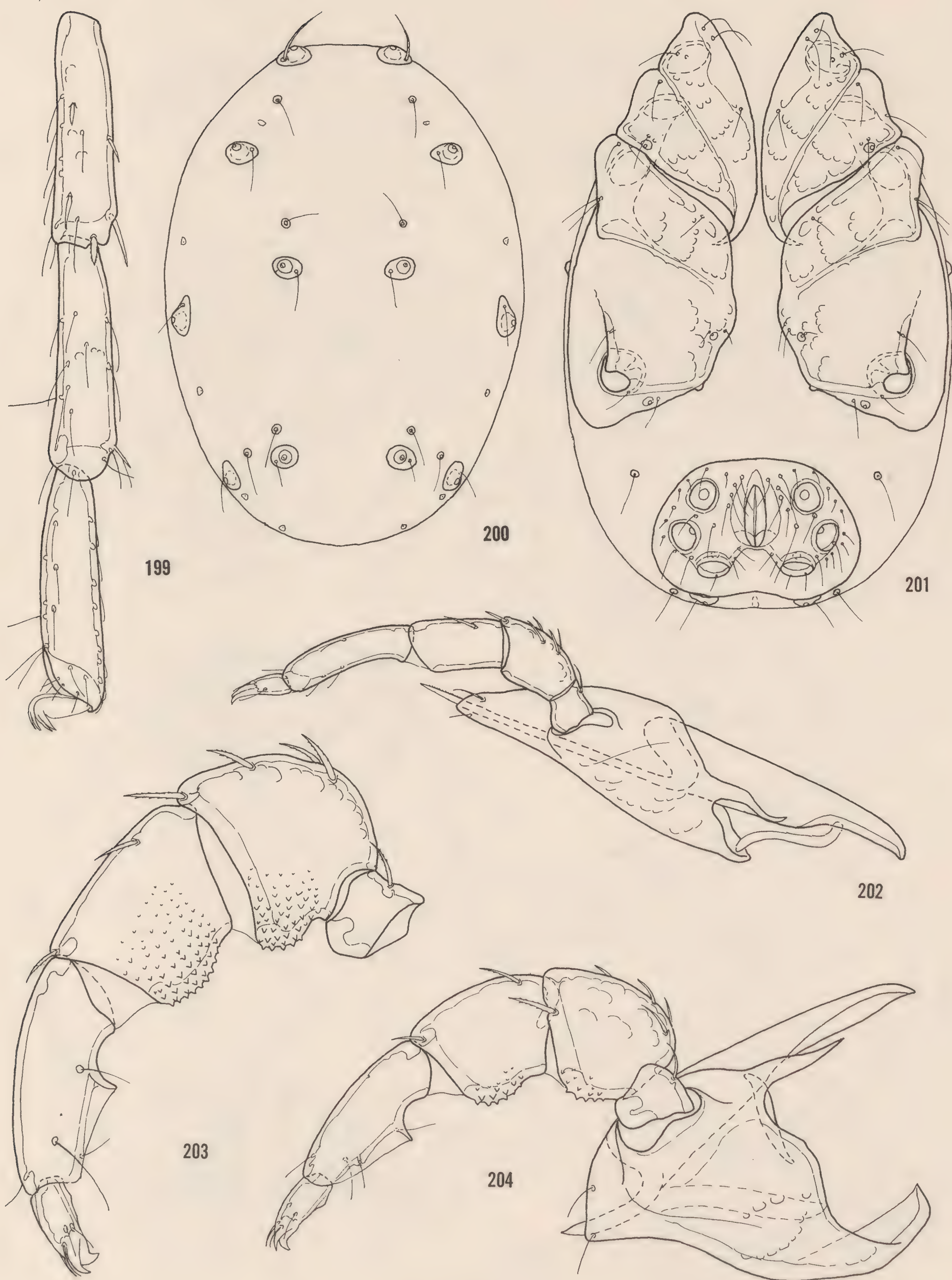
Aspidiobates orbiculatus Hopkins (Female) Fig. 187, distal segments of first leg; Fig. 188, dorsal shield; Fig. 189, ventral shield; Fig. 192, palp.

Aciculacarus papillosus Hopkins Fig. 190, palp, ♂; Fig. 191, lateral view of capitulum, chelicera and palp, ♀.



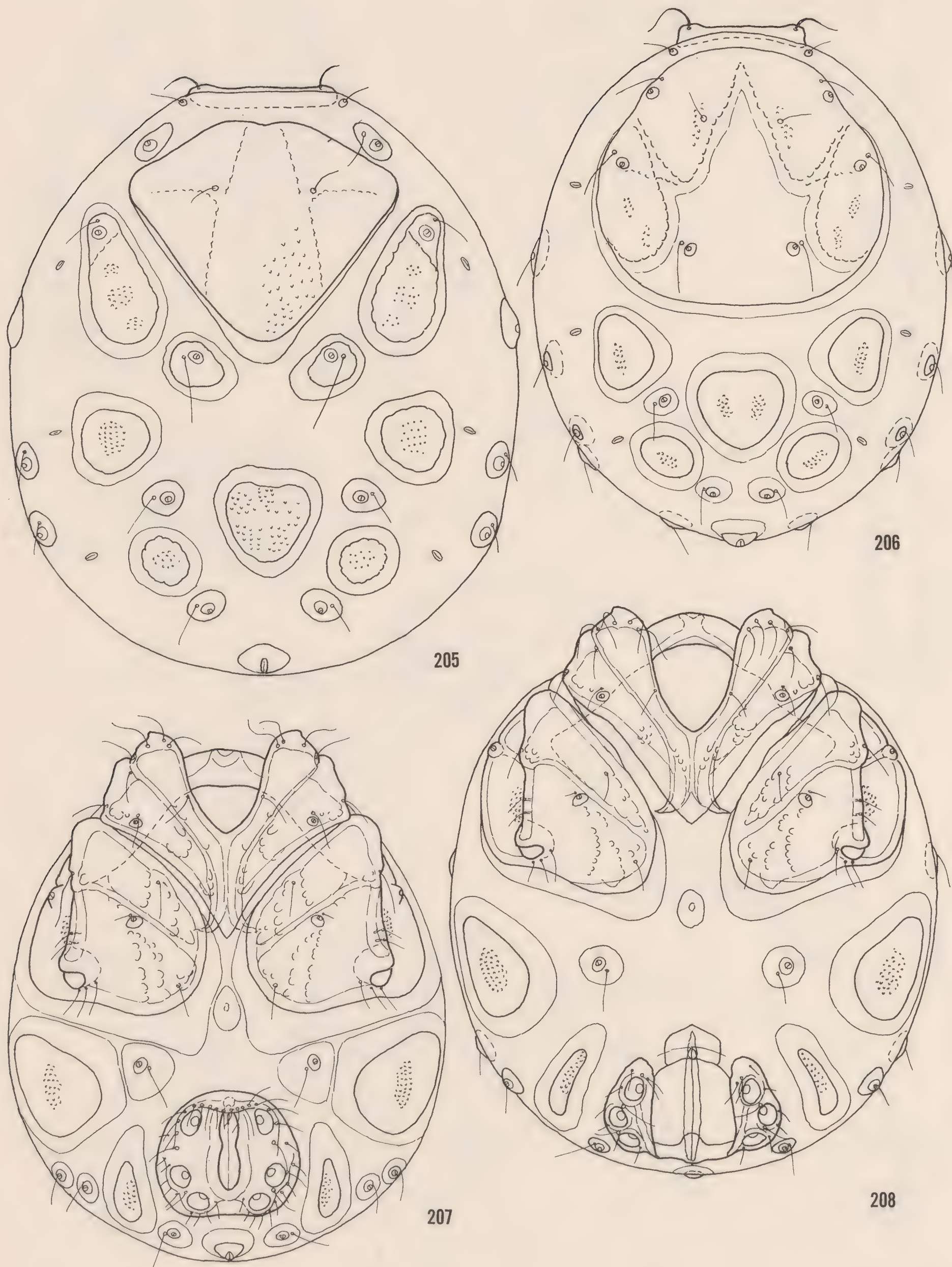
Aciculacarus papillosus Hopkins Fig. 193, ventral shield, ♂; Fig. 194, dorsal view, ♀; Fig. 195, chelicera, ♂; Fig. 196, distal segments of first leg, ♀; Fig. 197, ventral shield, ♀.

Aciculacarus amalis n. sp. Fig. 198, palp, ♂.

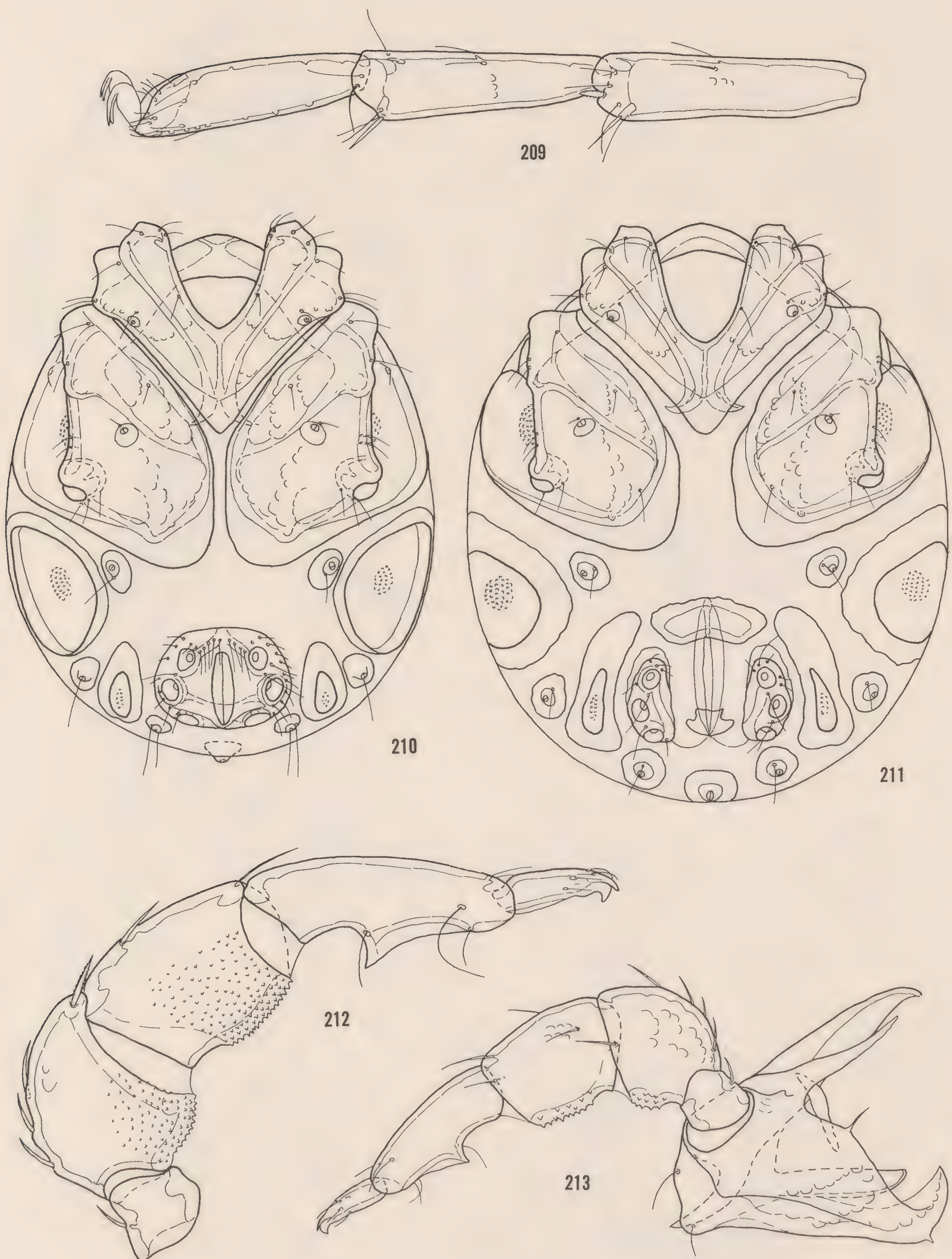


Aciculacarus amalis n. sp. (Male) Fig. 199, distal segments of first leg; Fig. 200, dorsal view; Fig. 201, ventral view; Fig. 202, lateral view of capitulum, chelicera and palp.

Zelandobates tornus n. sp. Fig. 203, palp, ♀; Fig. 204, lateral view of capitulum, chelicera and palp, ♂.

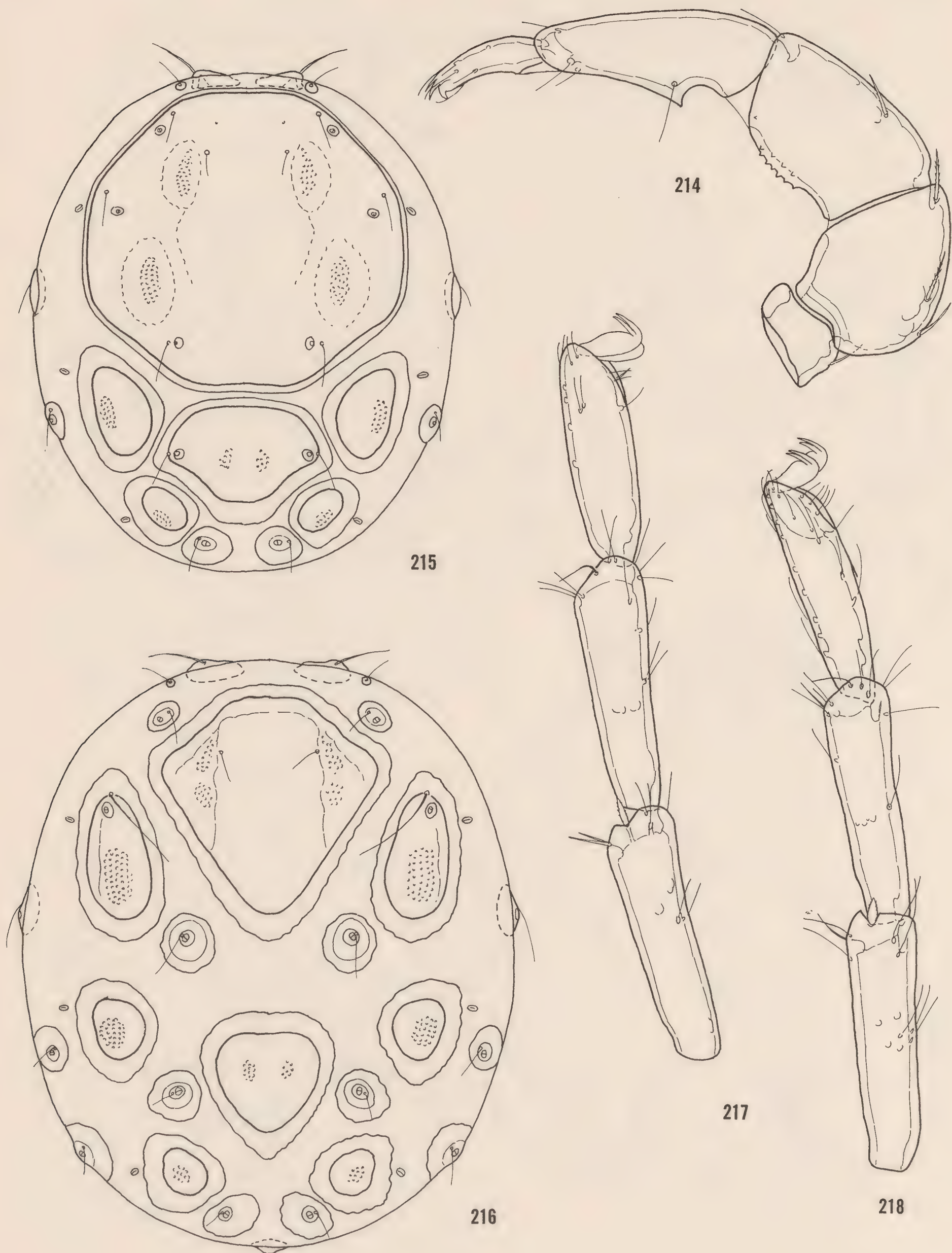


Zelandobates tornus n. sp. Fig. 205, dorsal view, ♀; Fig. 206, dorsal view, ♂; Fig. 207, ventral view, ♂; Fig. 208, ventral view, ♀.



Zelandobates tornus n. sp. Fig. 209, distal segments of first leg, ♀.

Zelandobates clevatus n. sp. Fig. 210, ventral view, ♂; Fig. 211, ventral view, ♀; Fig. 212, palp, ♀; Fig. 213, lateral view of capitulum, chelicera and palp, ♂.



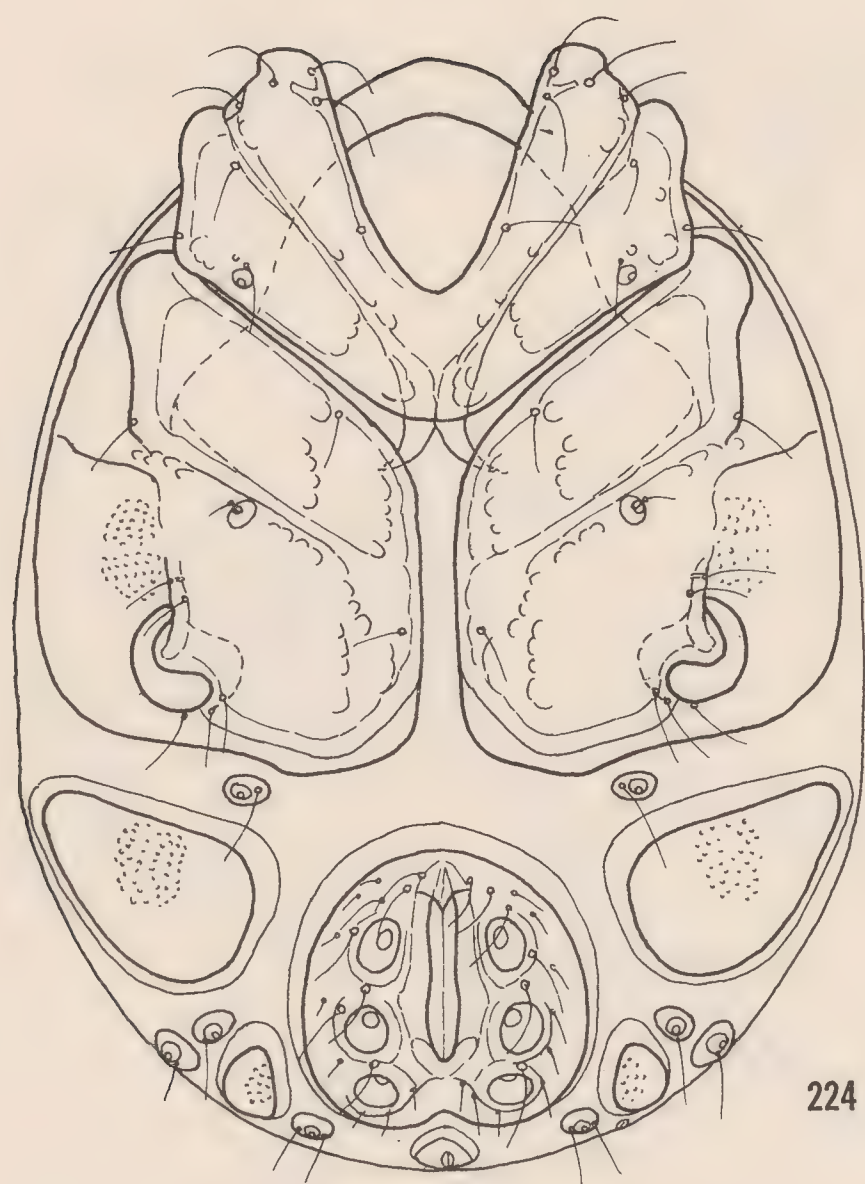
Zelandobates clevatus n. sp. Fig. 215, dorsal view, ♂; Fig. 216, dorsal view, ♀; Fig. 218, distal segments of first leg, ♀.

Zelandobatella naias Hopkins Fig. 214, palp, ♂; Fig. 217, distal segments of first leg, ♀.

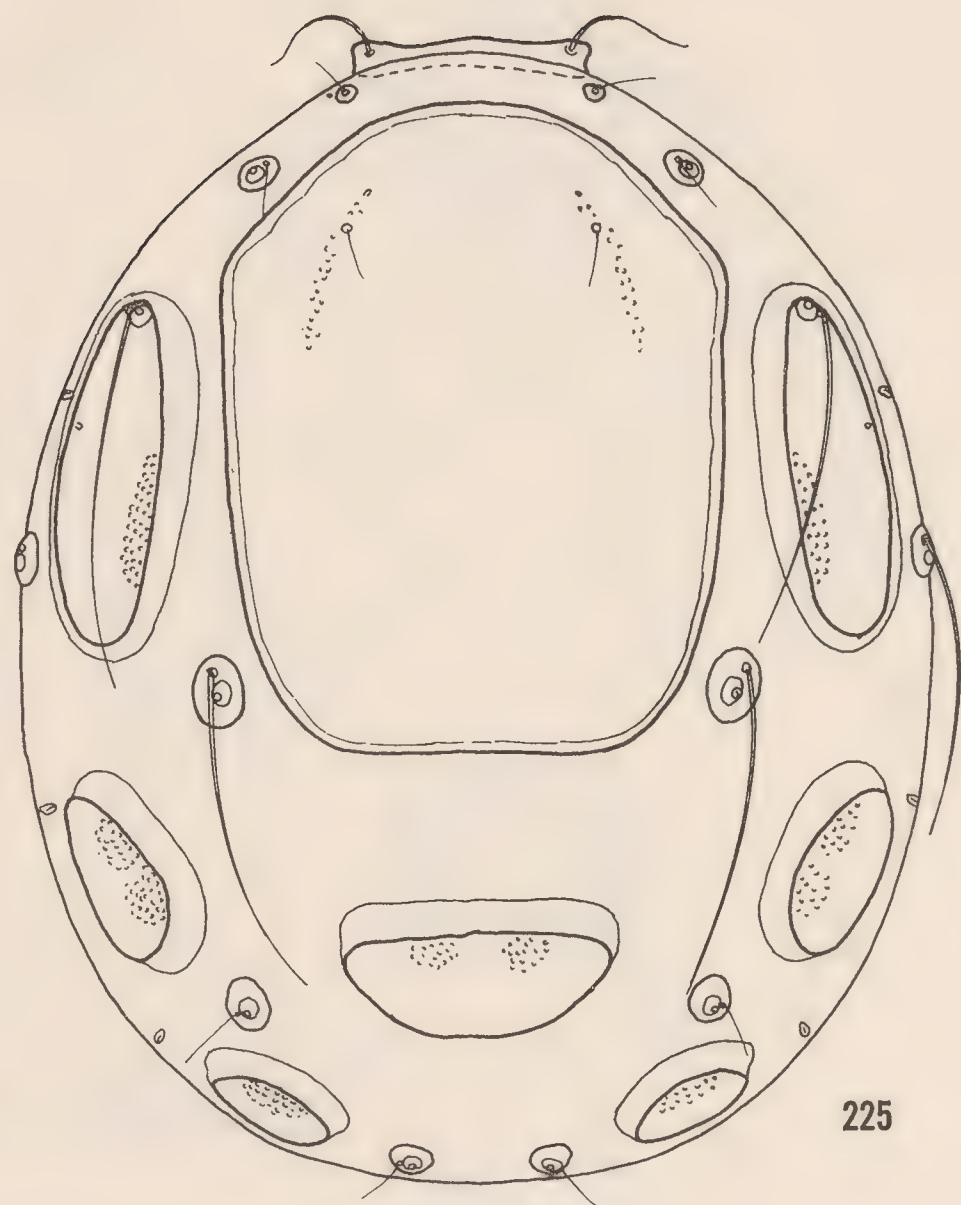


Zelandobatella naias Hopkins Fig. 219, ventral view, ♂; Fig. 220, dorsal view, ♂; Fig. 221, lateral view of capitulum, chelicera and palp, ♀; Fig. 222, ventral view, ♀.

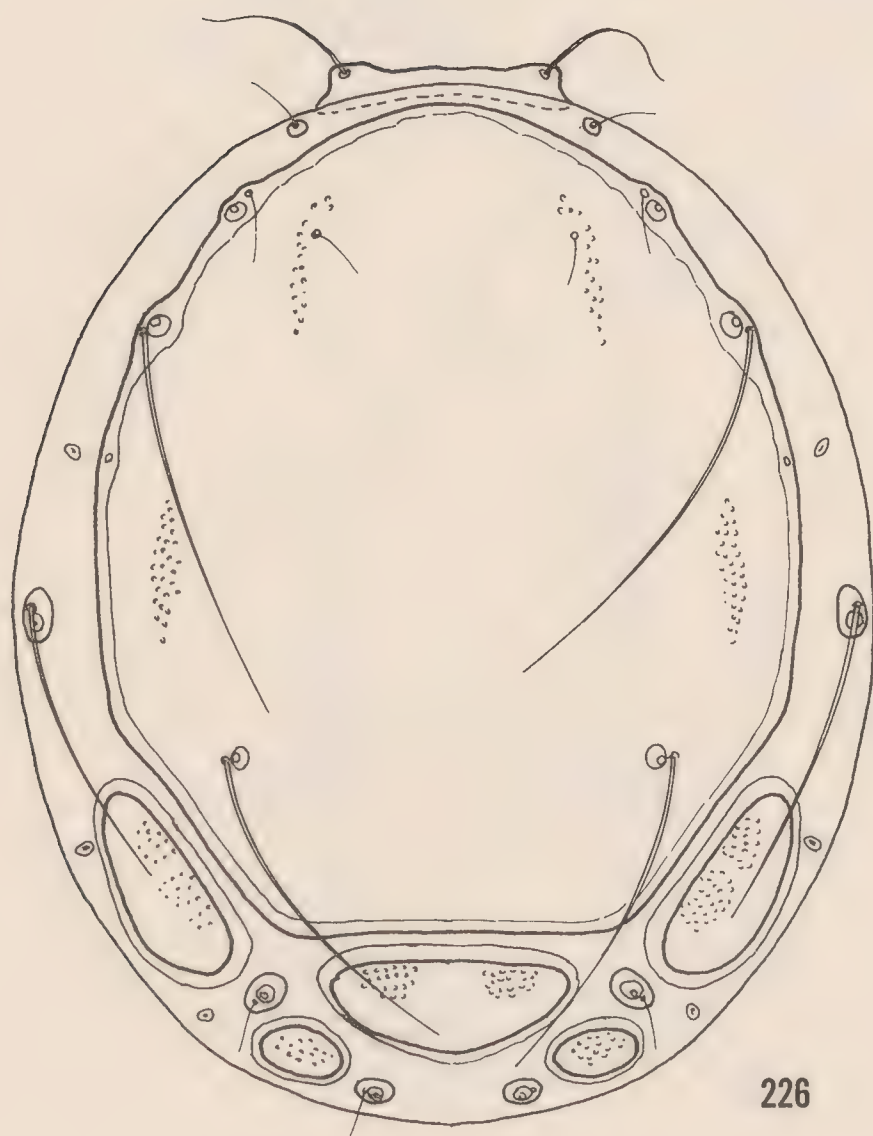
Zelandobates crinitus Hopkins Fig. 223, palp, ♂.



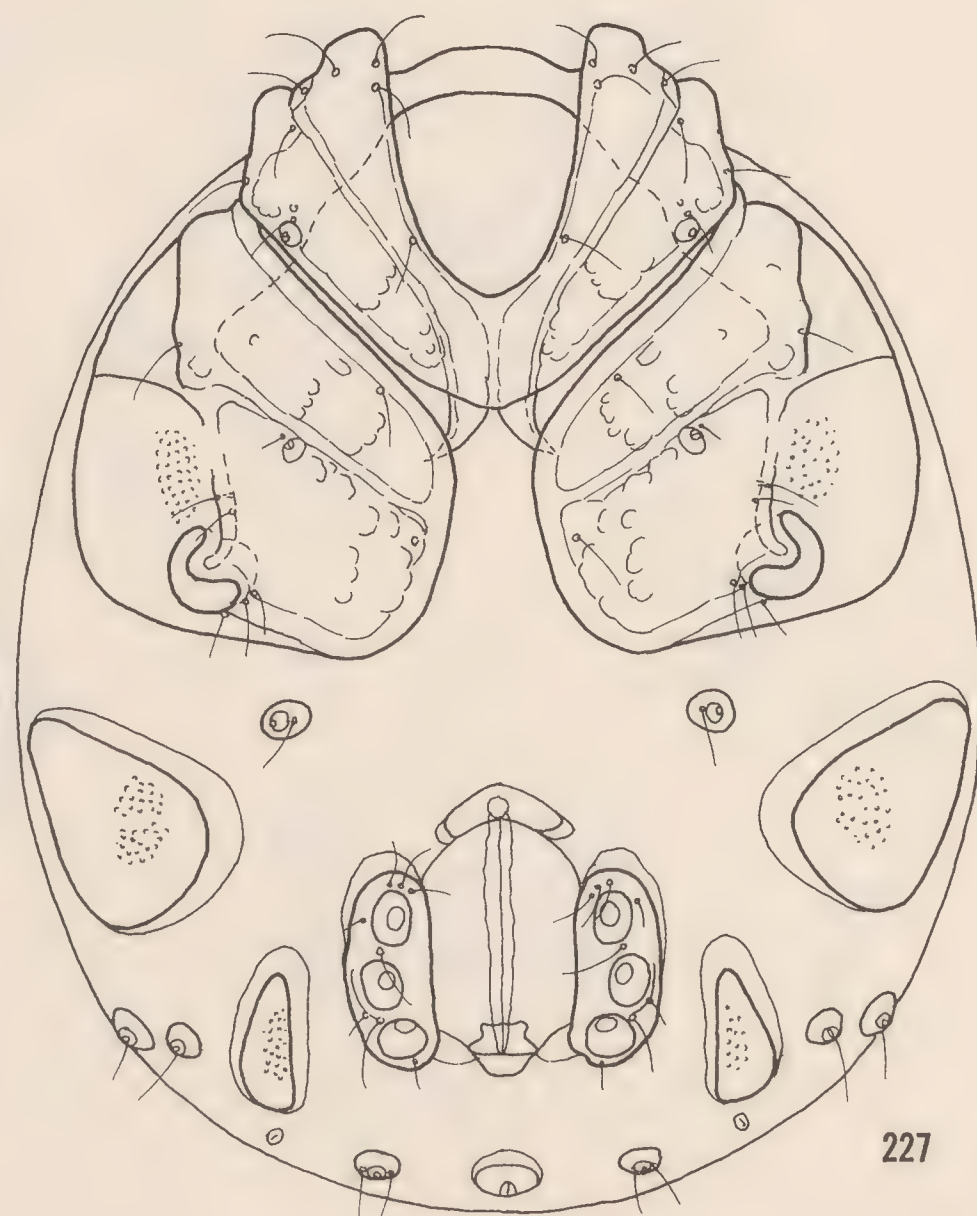
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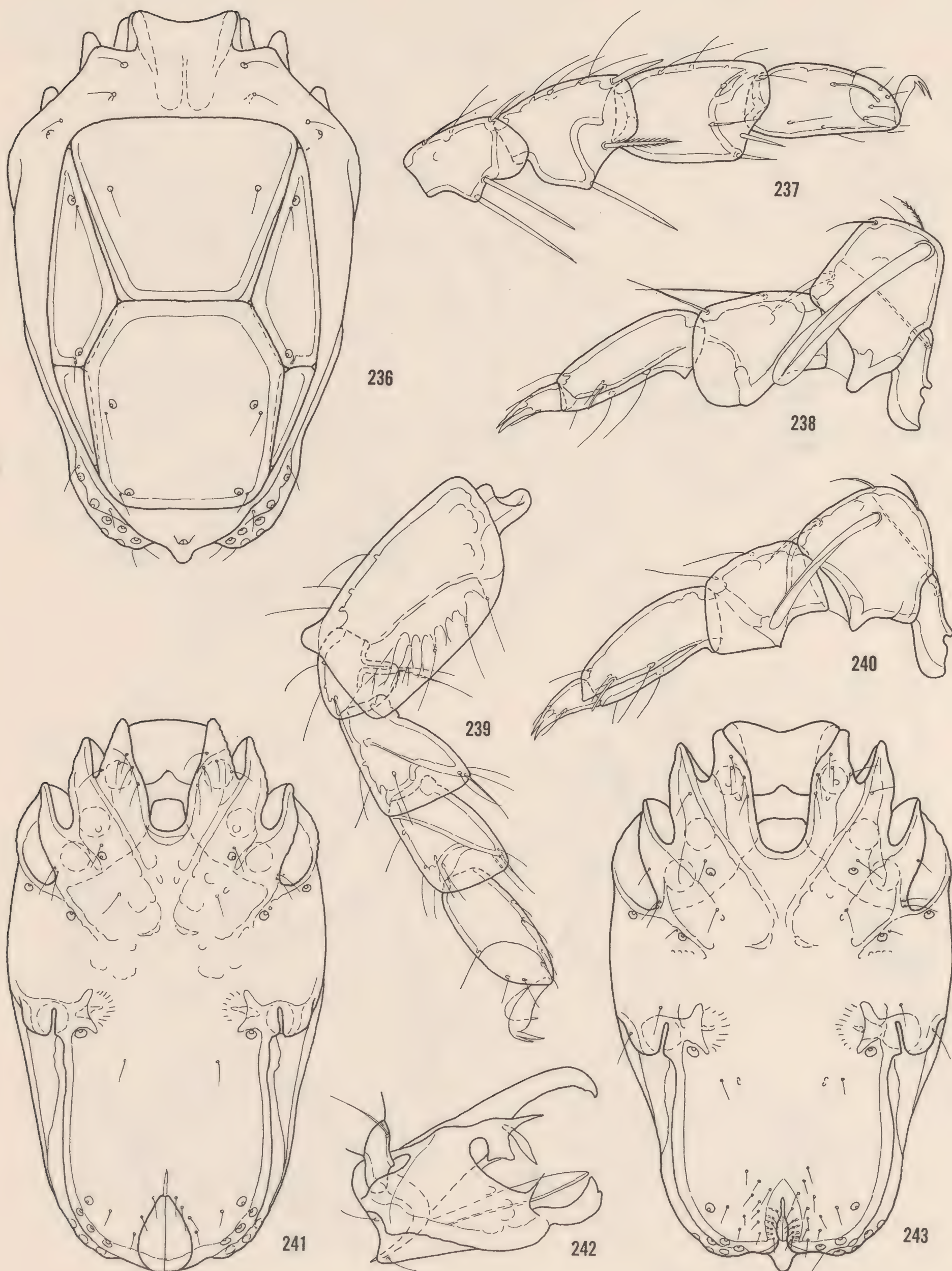
227

Zelandobates crinitus Hopkins Fig. 224, ventral view, ♂; Fig. 225, dorsal view, ♀; Fig. 226, dorsal view, ♂; Fig. 227, ventral view, ♀.

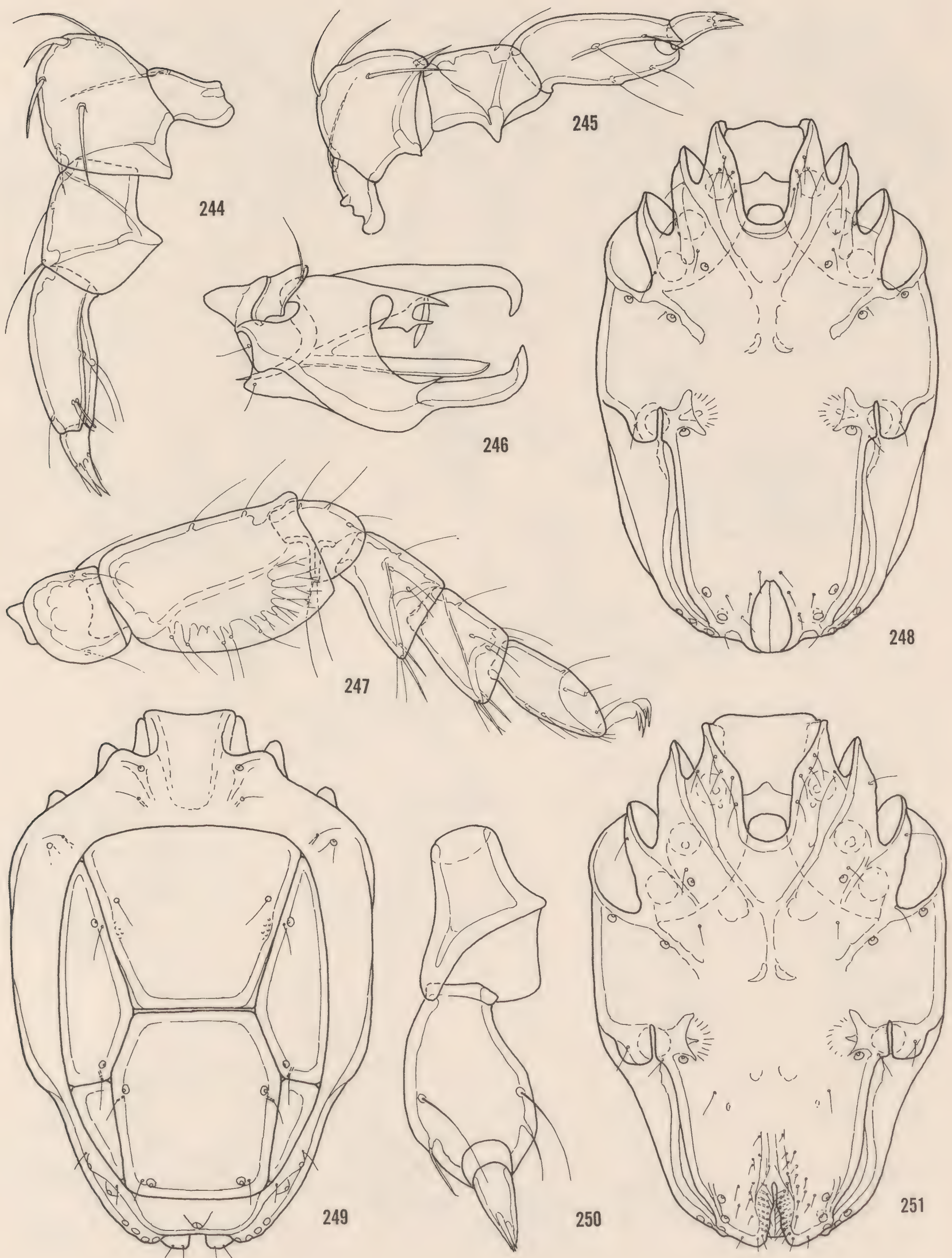


Piona exigua Viets (Male) Fig. 228, ejaculatory complex; Fig. 230, IV-Leg-4; Fig. 232, palp; Fig. 233, III-Leg-5 and 6; Fig. 234, I-Leg-5 and 6; Fig. 235, ventral sclerites.

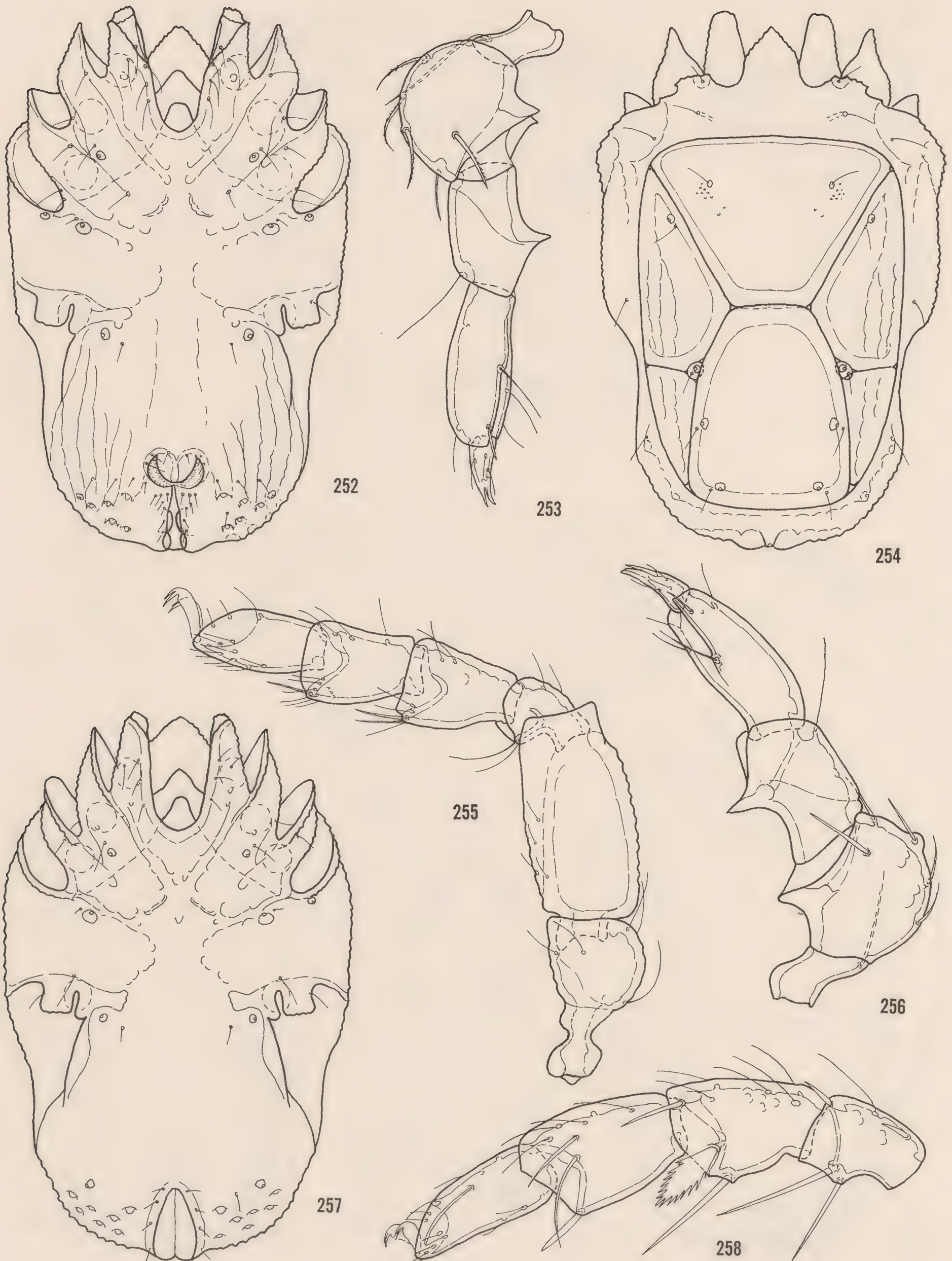
Zelandobates crinitus Hopkins Fig. 229, distal segments of first leg, ♀; Fig. 231, lateral view of capitulum, chelicera and palp, ♀.



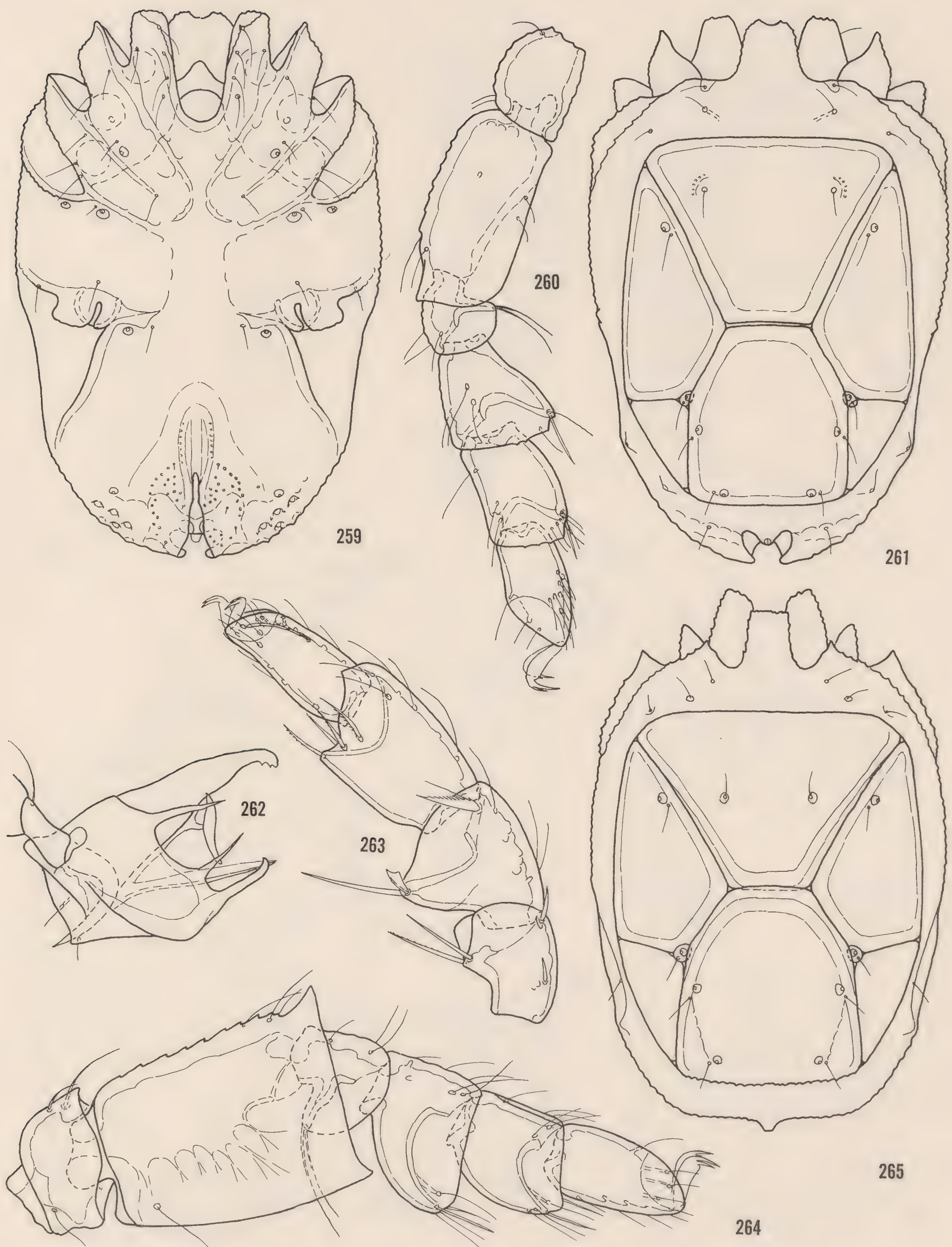
Planaturus setipalpis n. sp. Fig. 236, dorsal view, ♂; Fig. 237, distal segments of first leg, ♀; Fig. 238, palp, ♂; Fig. 239, fourth leg, ♂; Fig. 240, palp, ♀; Fig. 241, ventral shield, ♀; Fig. 242, capitulum, ♀; Fig. 243, ventral shield, ♂.



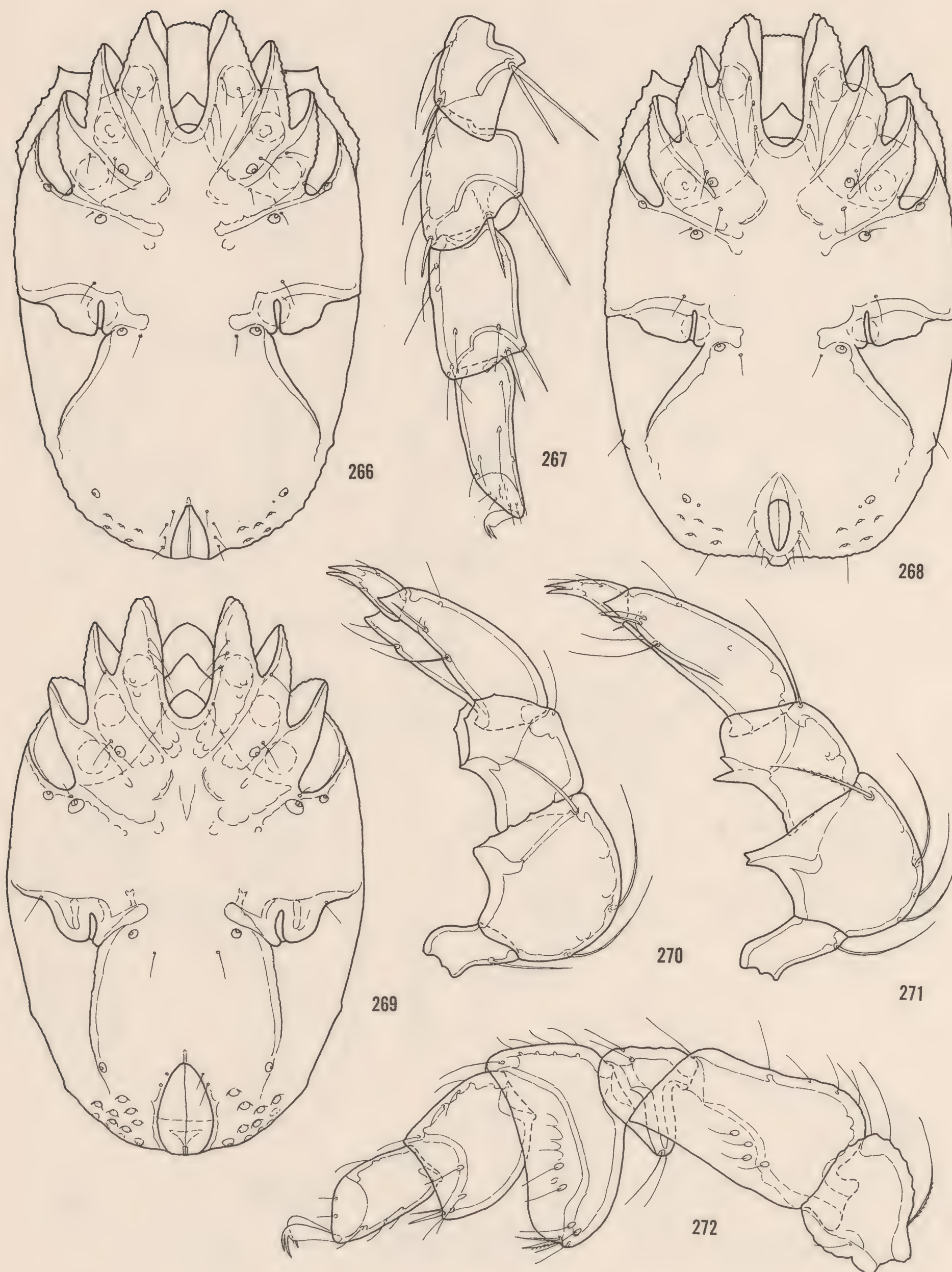
Planaturus lundbladi n. sp. Fig. 244, palp, ♂; Fig. 245, palp, ♀; Fig. 246, capitulum, ♂; Fig. 247, fourth leg, ♂; Fig. 248, ventral shield, ♀; Fig. 249, dorsal view, ♂; Fig. 250, ventral view of P-III through V, ♂; Fig. 251, ventral shield, ♂.



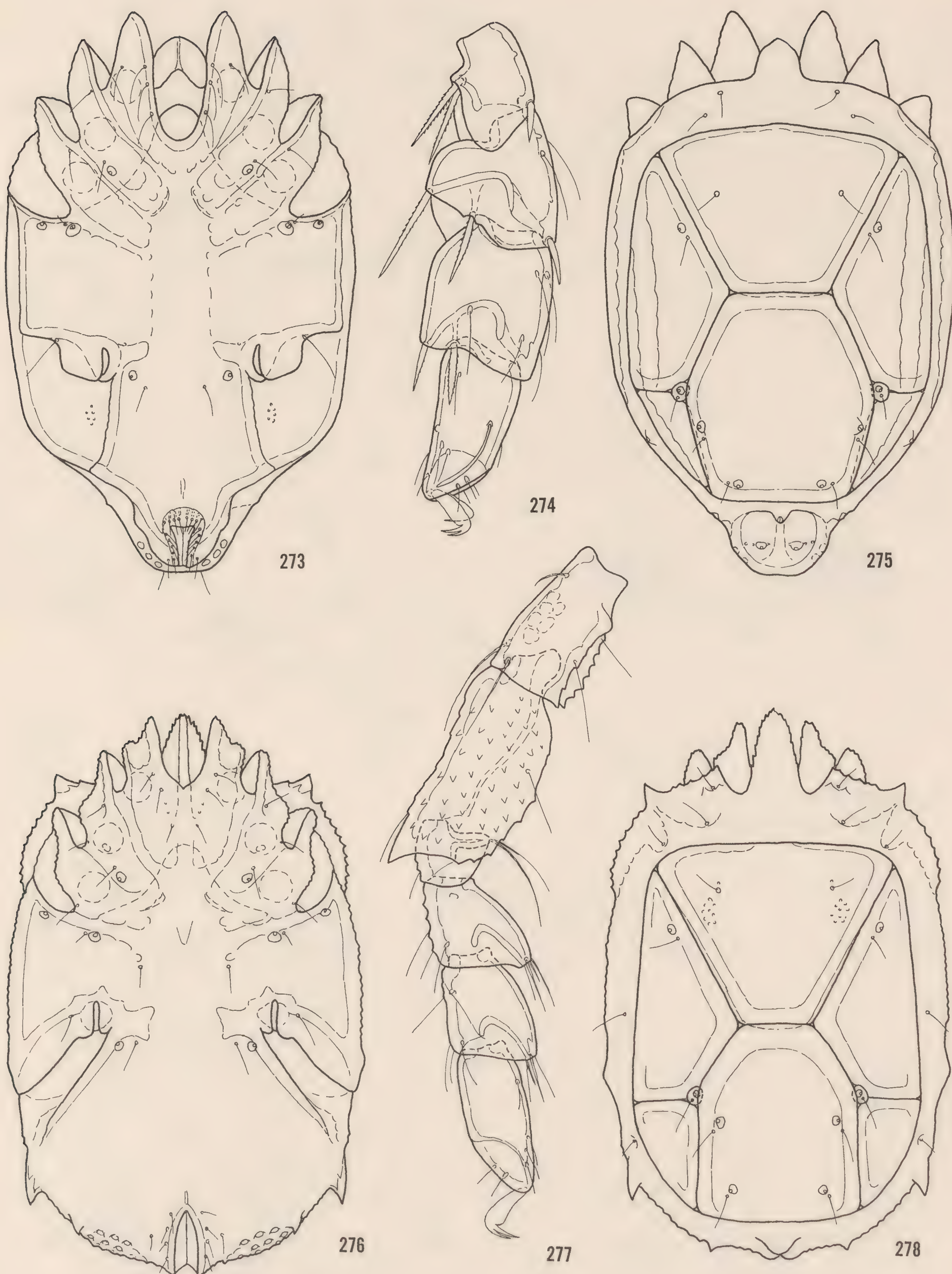
Taintaturus abditus n. sp. Fig. 252, ventral shield, ♂; Fig. 253, palp, ♂; Fig. 254, dorsal view, ♂; Fig. 255, fourth leg, ♂; Fig. 257, ventral view, ♀; Fig. 258, distal segments of first leg, ♂.
Taintaturus accidens n. sp. Fig. 256, palp, ♂.



Taintaturus accidens n. sp. Fig. 259, ventral shield, ♂; Fig. 260, fourth leg, ♂; Fig. 261, dorsal view, ♂; Fig. 263, distal segments of first leg, ♂.
Taintaturus hopkinsi n. sp. Fig. 262, capitulum, ♀; Fig. 264, fourth leg, ♂; Fig. 265, dorsal view, ♂.

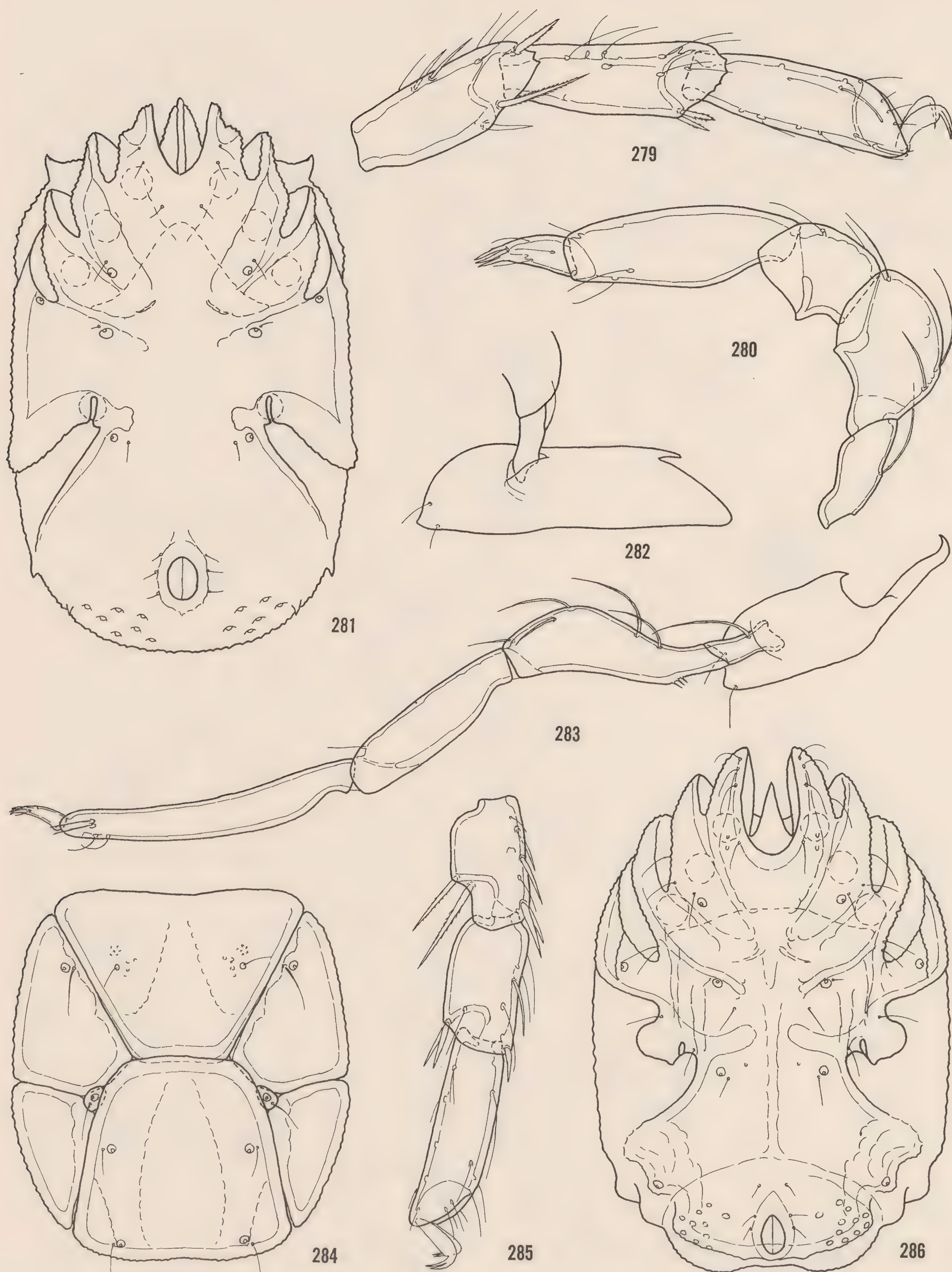


Taintaturus hopkinsi n. sp. Fig. 266, ventral shield, ♀; Fig. 267, distal segments of first leg, ♀; Fig. 268, ventral shield, ♂; Fig. 271, palp, ♀.
Taintaturus projectus n. sp. Fig. 269, ventral shield, ♀; Fig. 270, palp, ♀;
 Fig. 272, fourth leg, ♂.



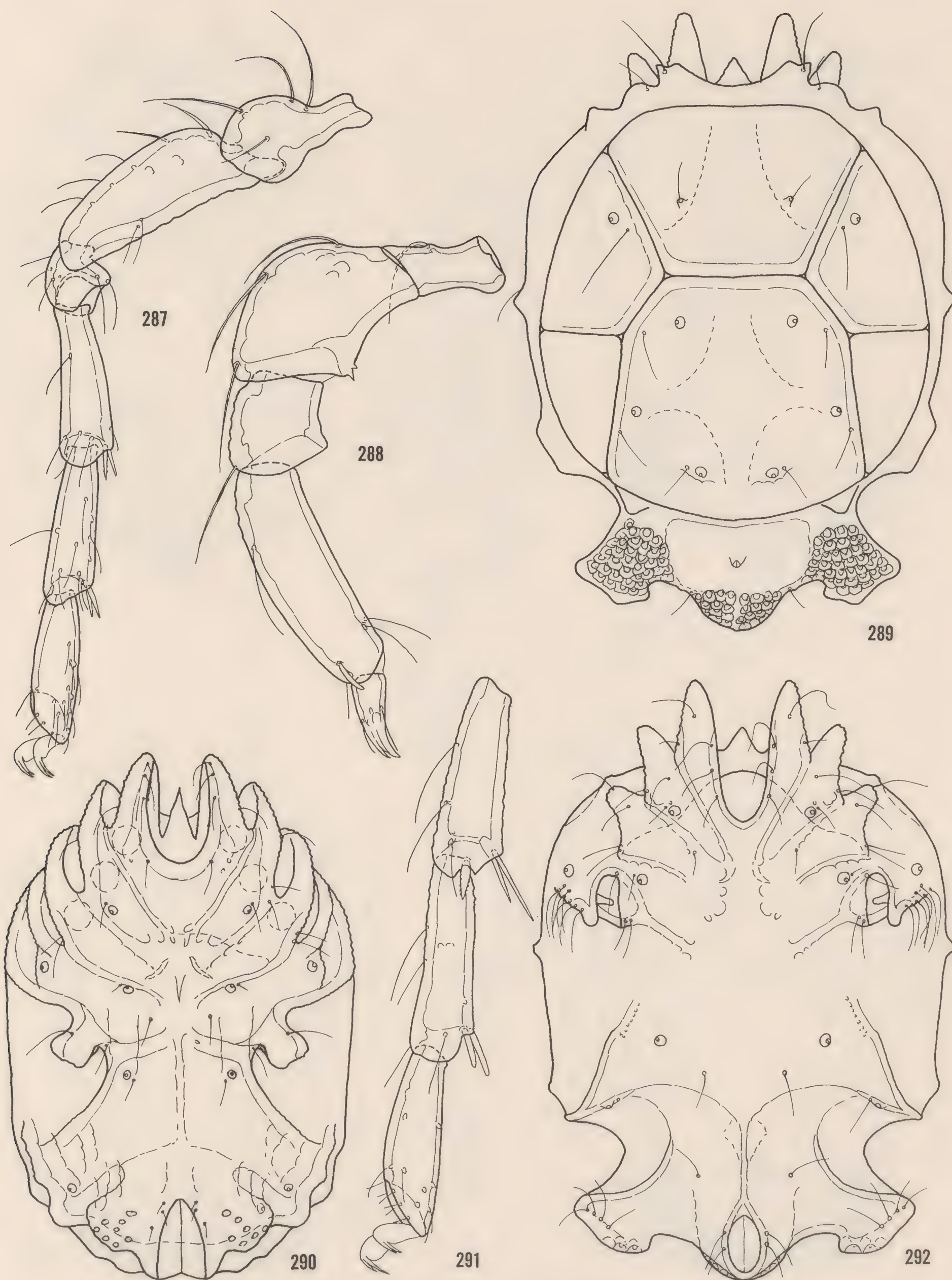
Taintaturus projectus n. sp. Fig. 273, ventral shield, ♂; Fig. 274, distal segments of first leg, ♀; Fig. 275, dorsal view, ♂.

Abelaturus cornophorus n. sp. Fig. 276, ventral shield, ♀; Fig. 277, fourth leg, ♀; Fig. 278, dorsal view, ♀.

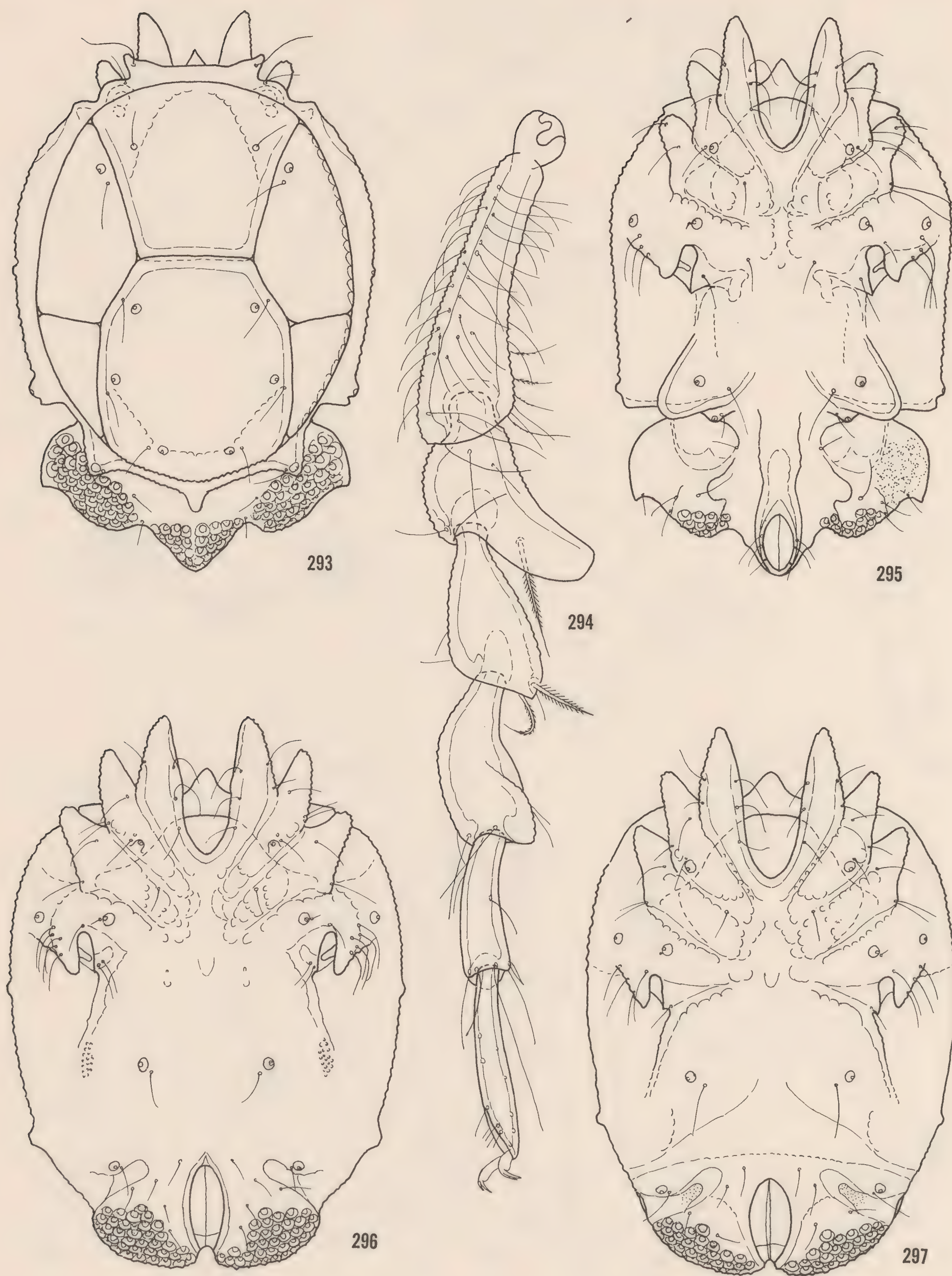


Omegaturus longipalpis n. sp. Fig. 279, distal segments of first leg, ♀; Fig. 283, lateral view of capitulum and palp, ♀; Fig. 284, dorsal shield, ♂; Fig. 286, ventral view, ♂.

Abelaturus cornophorus n. sp. Fig. 280, palp, ♀; Fig. 281, ventral shield, ♂; Fig. 282, capitulum, ♀; Fig. 285, distal segments of first leg, ♀.

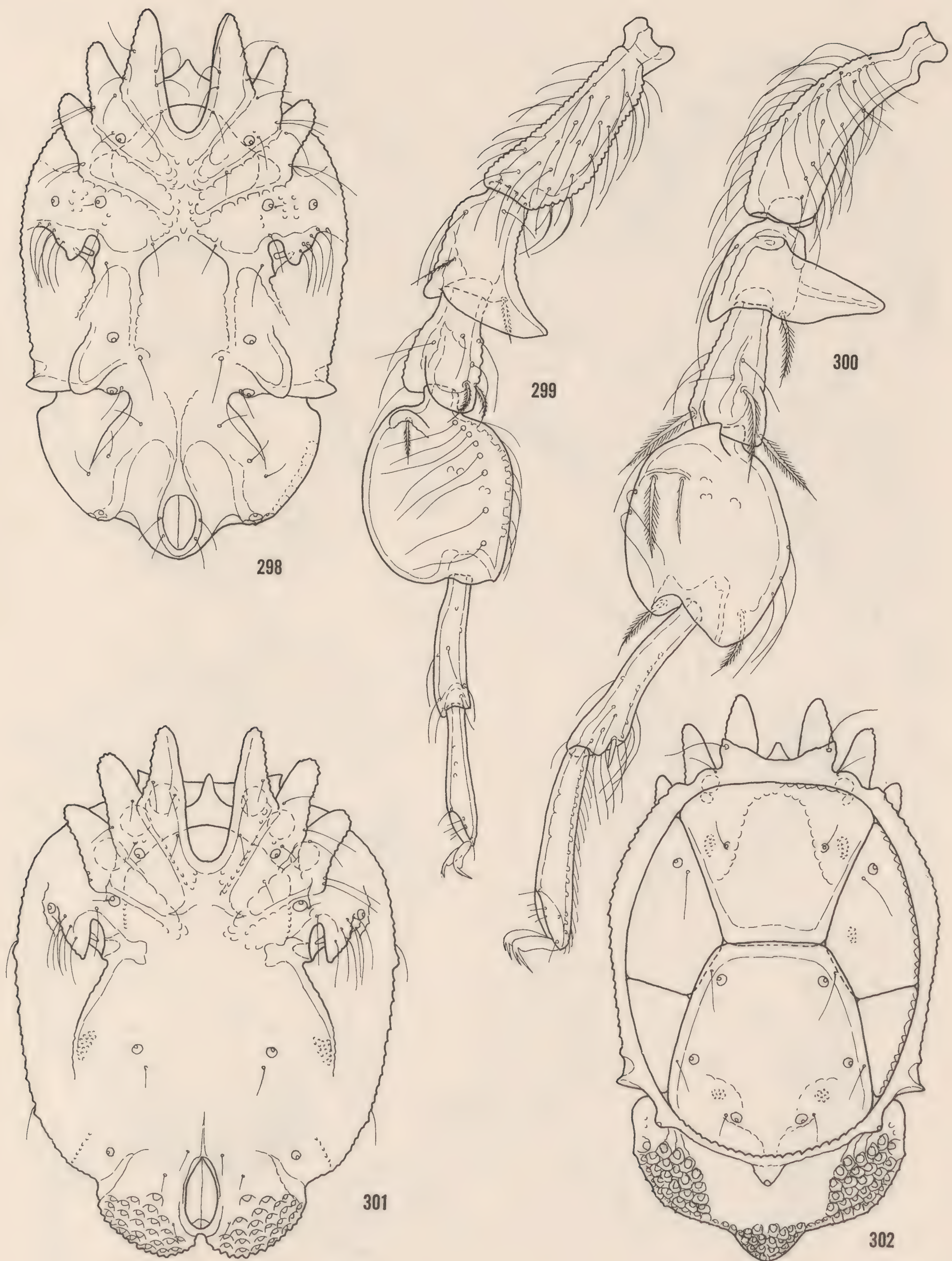


Omegaturus longipalpis n. sp. Fig. 287, fourth leg, ♂; Fig. 290, ventral view, ♀.
Tryssaturopsis asopos n. sp. Fig. 288, palp, ♀; Fig. 289, dorsal view, ♂; Fig.
 291, distal segments of first leg, ♀; Fig. 292, ventral shield, ♂.



Tryssaturopsis novus (Hopkins) Fig. 293, dorsal view, ♂; Fig. 295, ventral shield, ♂; Fig. 297, ventral shield, ♀.

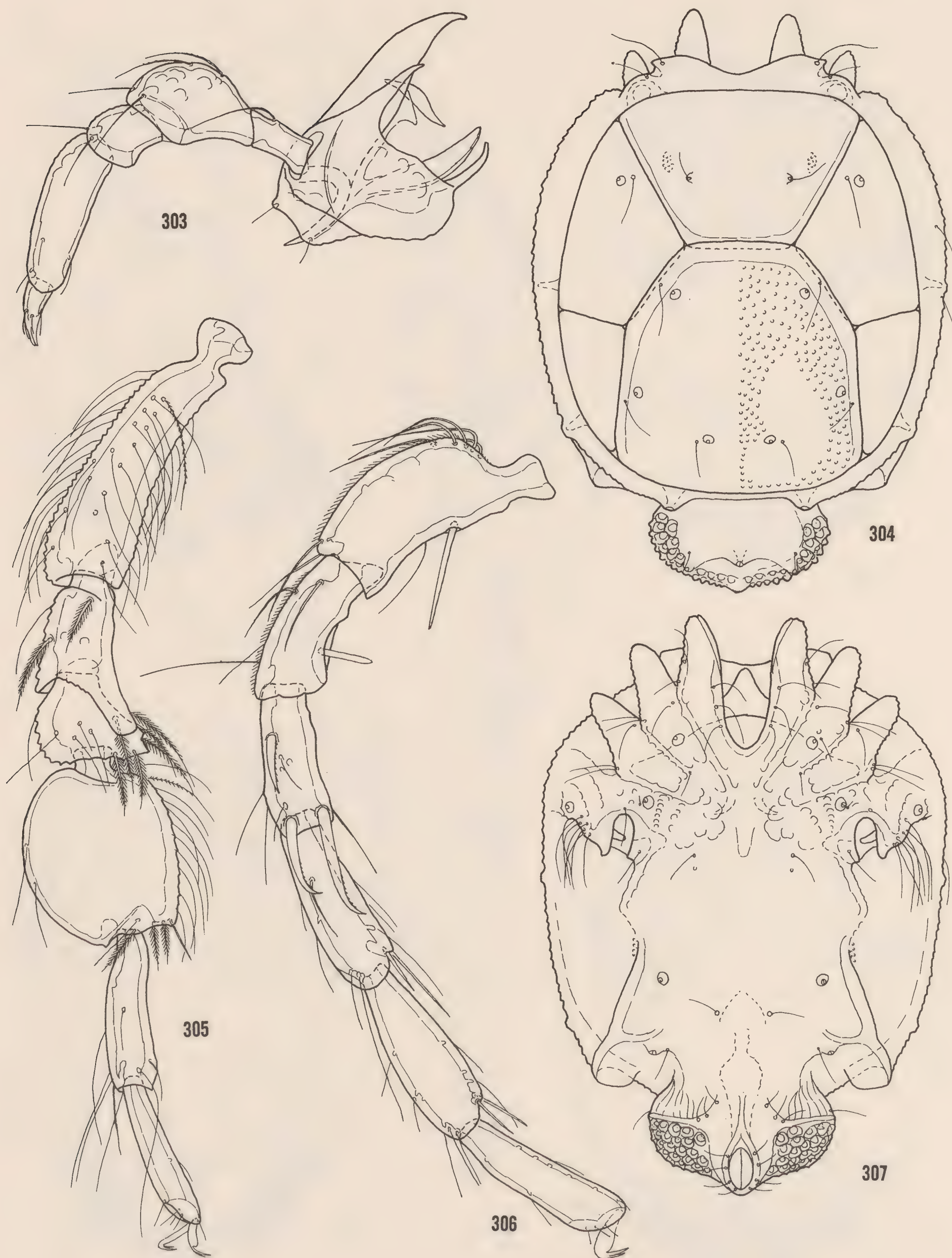
Tryssaturopsis asopos n. sp. Fig. 294, fourth leg, ♂; Fig. 296, ventral shield, ♀.



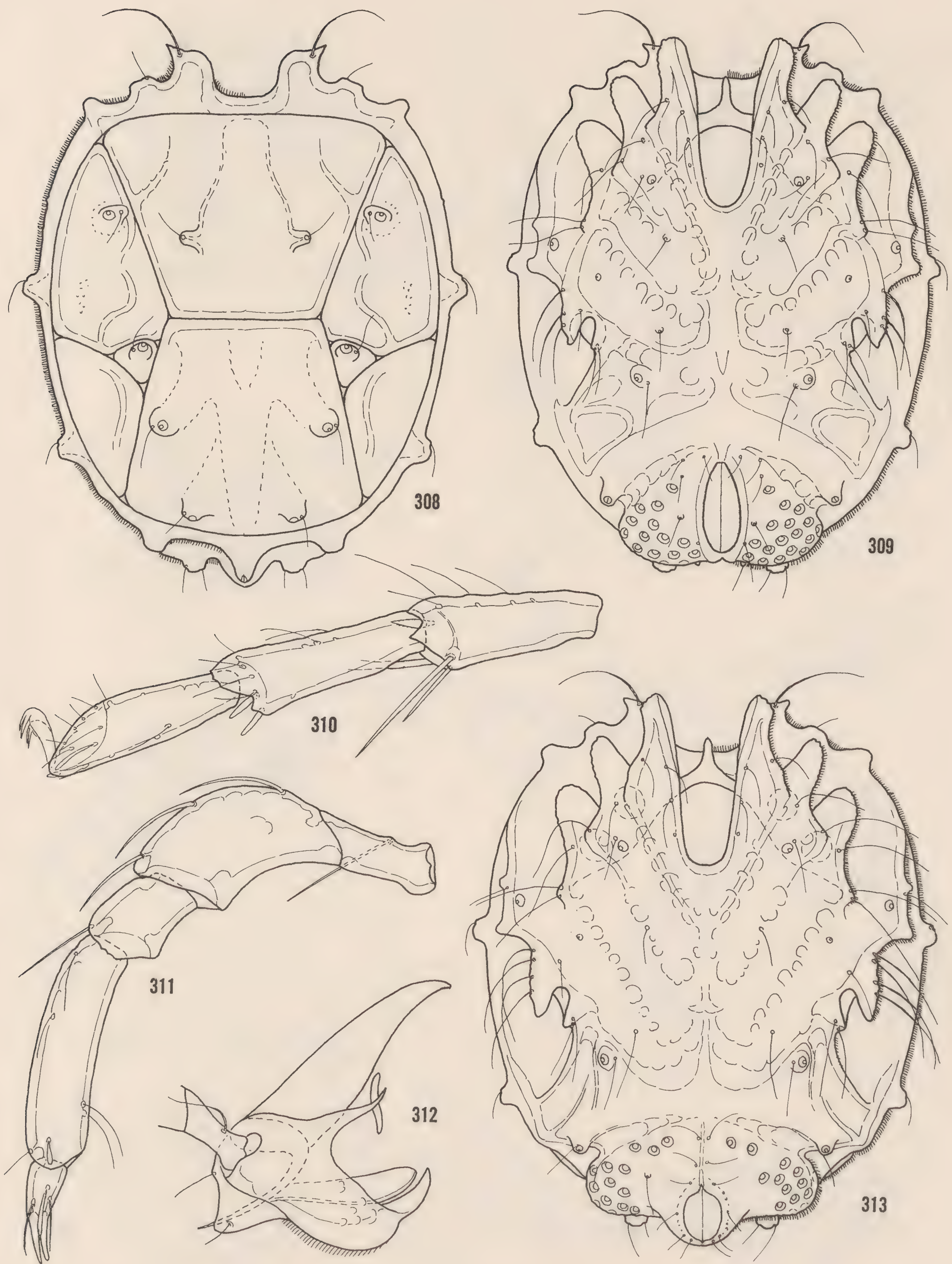
Tryssaturopsis solivagus n. sp. Fig. 298, ventral shield, ♂; Fig. 299, fourth leg, ♂; Fig. 302, dorsal view, ♂.

Tryssaturopsis novus (Hopkins) Fig. 300, fourth leg, ♂.

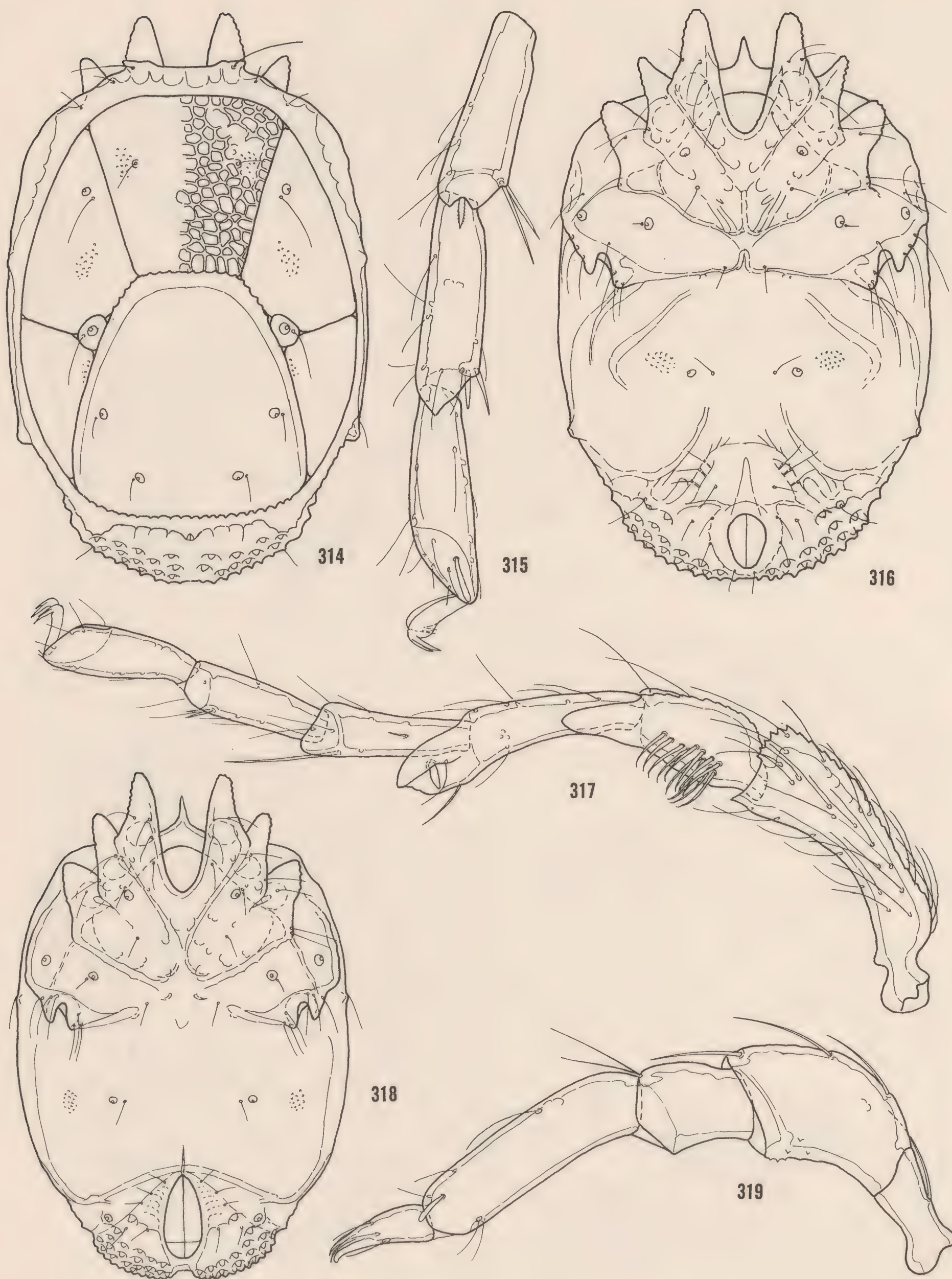
Tryssaturopsis parvicaudatus n. sp. Fig. 301, ventral shield, ♀.



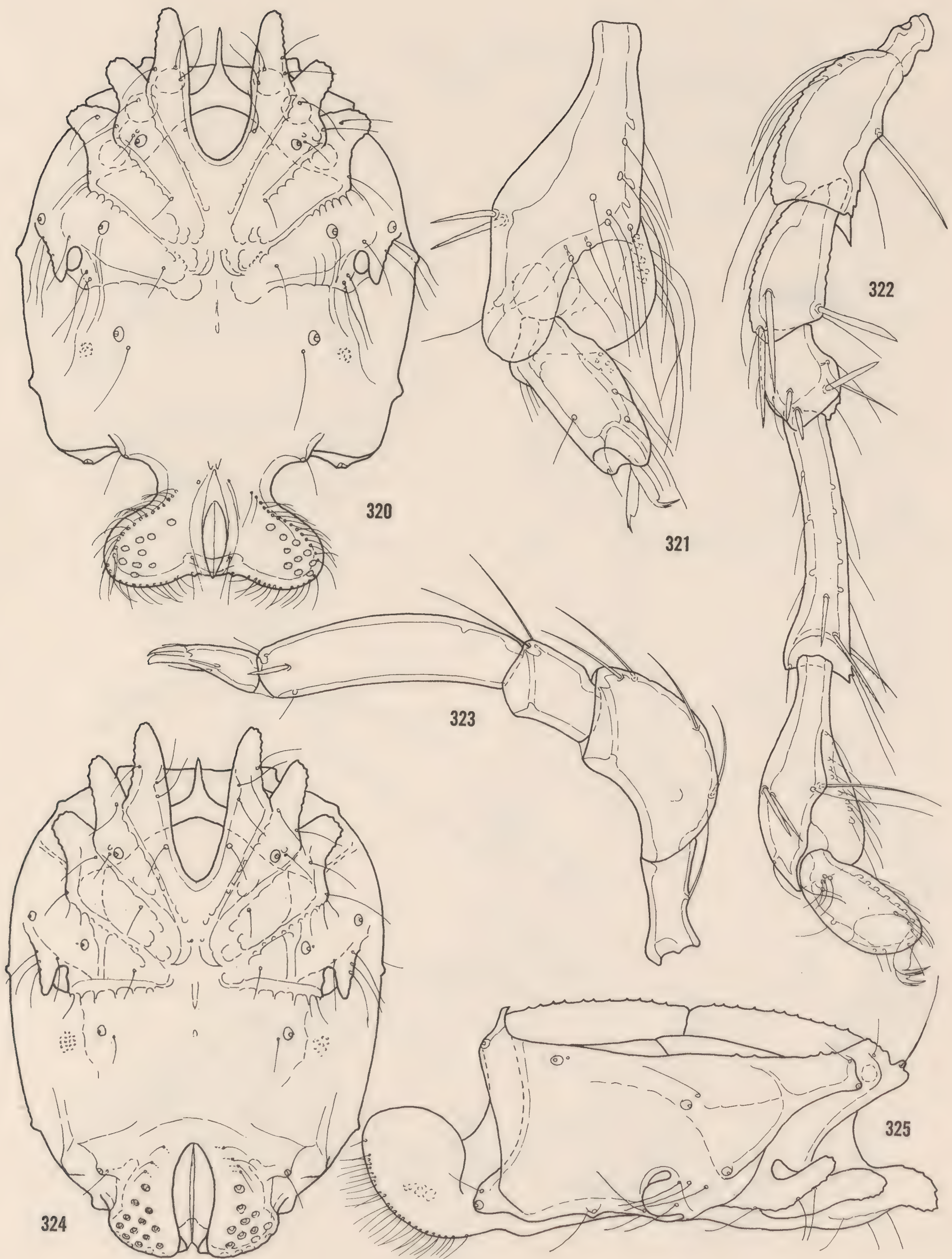
Tryssaturopsis parvicaudatus n. sp. Fig. 303, lateral view of capitulum, chelicera and palp, ♀; Fig. 304, dorsal view, ♂; Fig. 305, fourth leg, ♂; Fig. 307, ventral shield, ♂.
Pilosaturus villosus (Hopkins) Fig. 306, fourth leg, ♂.



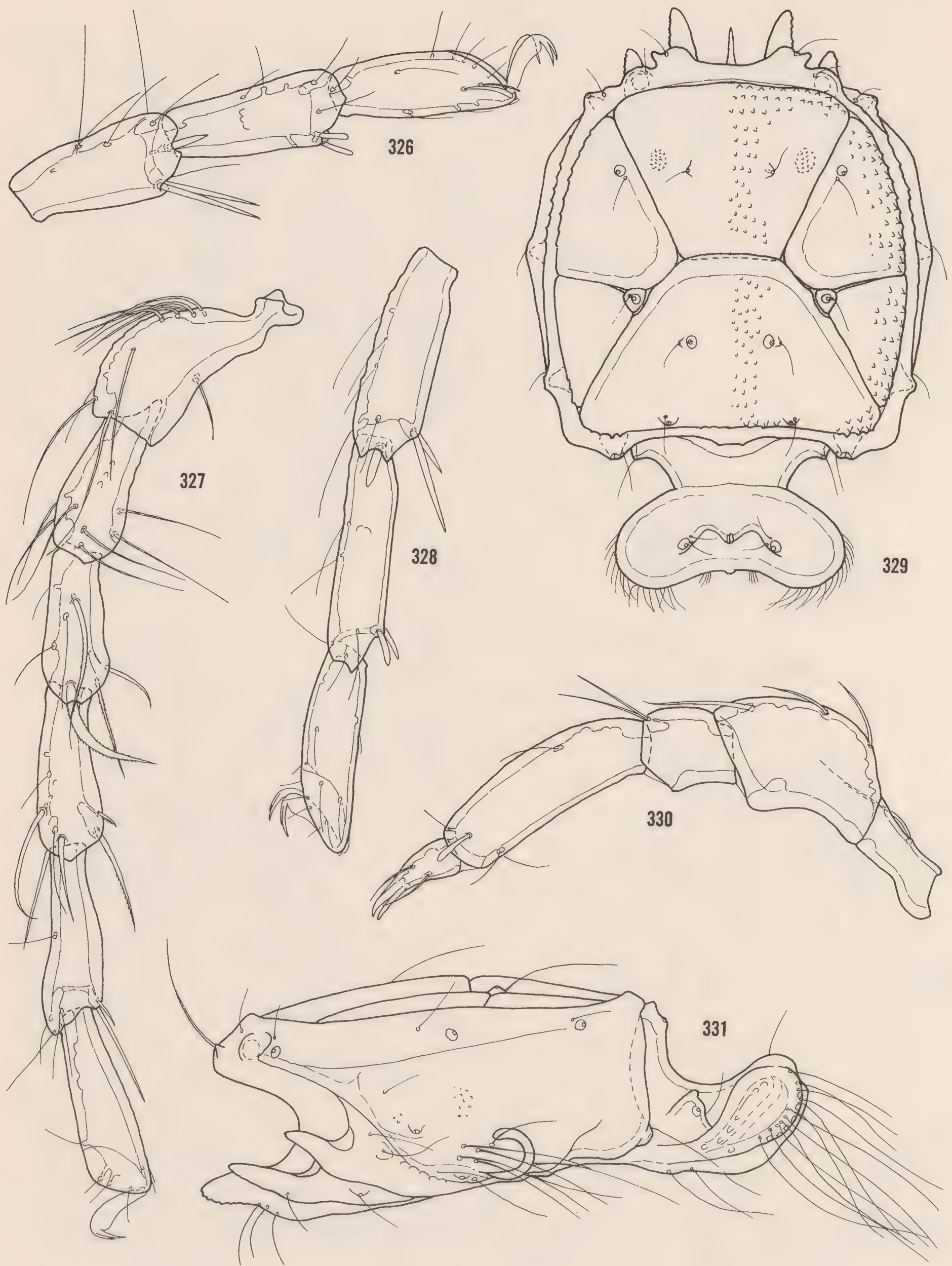
Pilosaturus villosus (Hopkins) Fig. 308, dorsal view, ♂; Fig. 309, ventral shield, ♀; Fig. 310, distal segments of first leg, ♀; Fig. 311, palp, ♀; Fig. 312, capitulum, ♀; Fig. 313, ventral shield, ♂.



Tryssaturus spinipes Hopkins Fig. 314, dorsal view, ♂; Fig. 315, distal segments of first leg, ♀; Fig. 316, ventral shield, ♂; Fig. 317, fourth leg, ♂; Fig. 318, ventral shield, ♀; Fig. 319, palp, ♀.

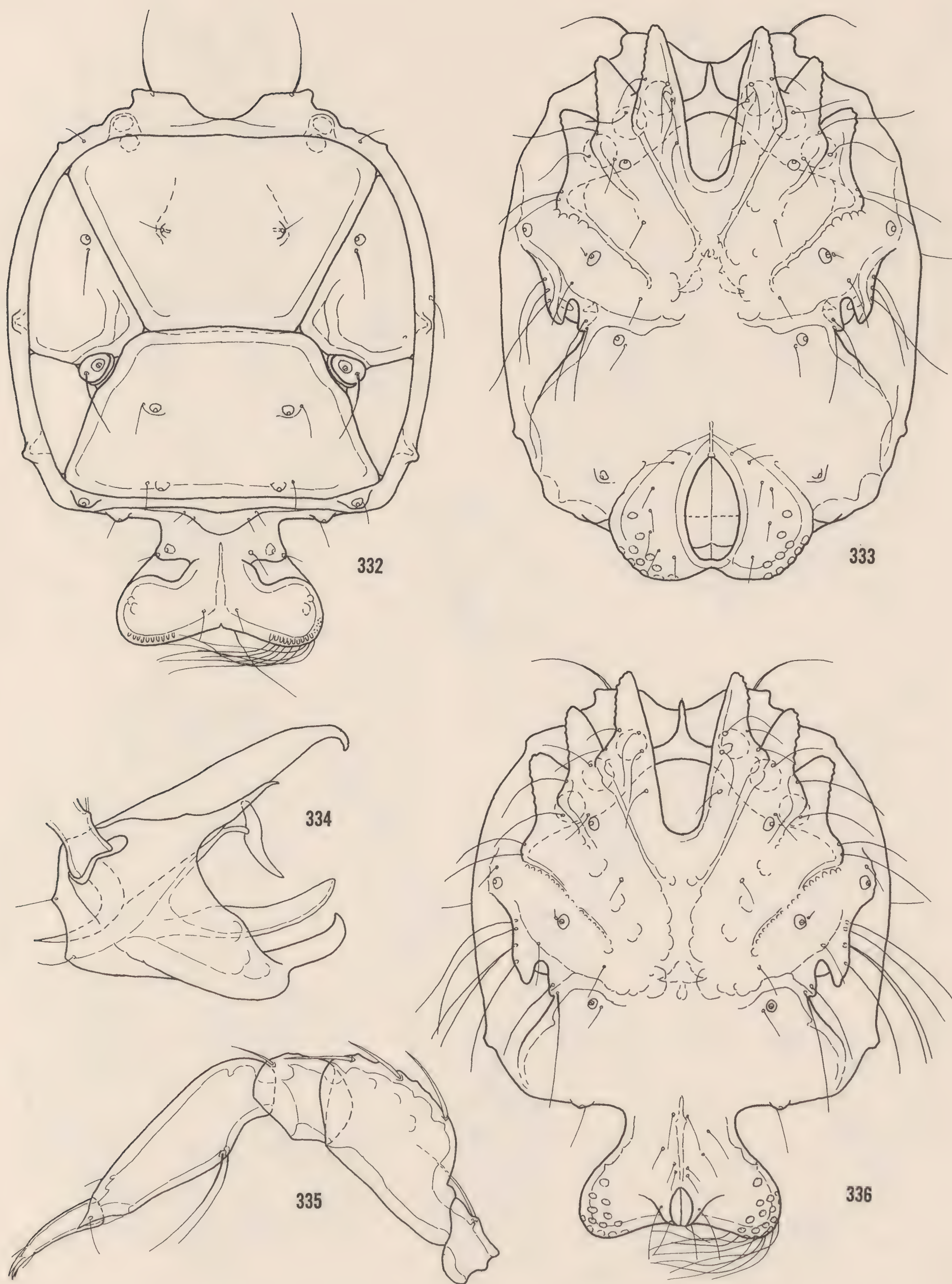


Neotryssaturus inusitatus (Hopkins) Fig. 320, ventral shield, ♂; Fig. 321, IV-Leg-5 and 6, ♂; Fig. 322, fourth leg, ♂; Fig. 323, palp, ♀; Fig. 324, ventral shield, ♀; Fig. 325, lateral view, ♂.

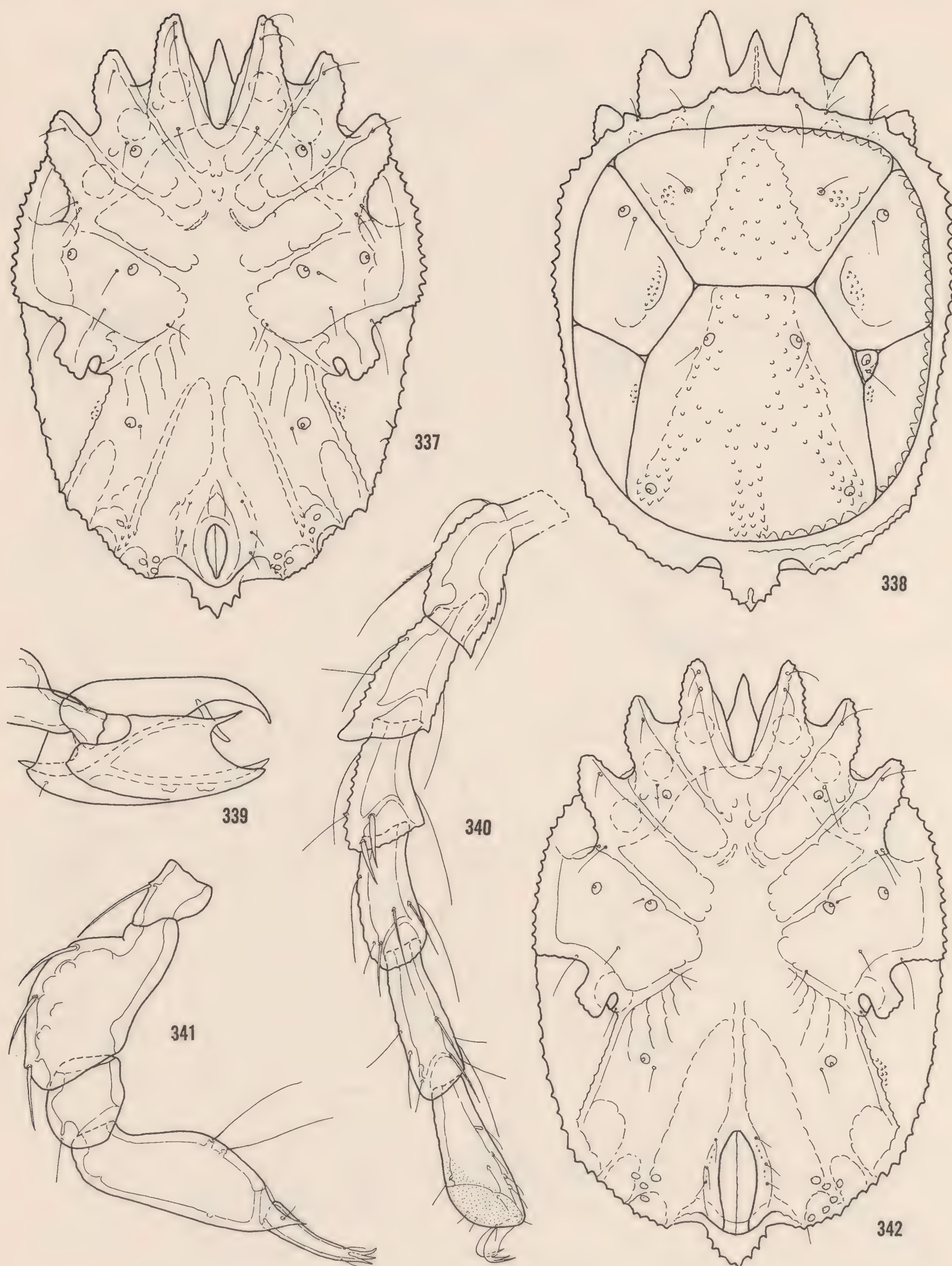


Neotryssaturus pallidus n. sp. Fig. 326, distal segments of first leg, ♀; Fig. 327, fourth leg, ♂; Fig. 330, palp, ♀; Fig. 331, lateral view, ♂.

Neotryssaturus inusitatus (Hopkins) Fig. 328, distal segments of first leg, ♀; Fig. 329, dorsal view, ♂.

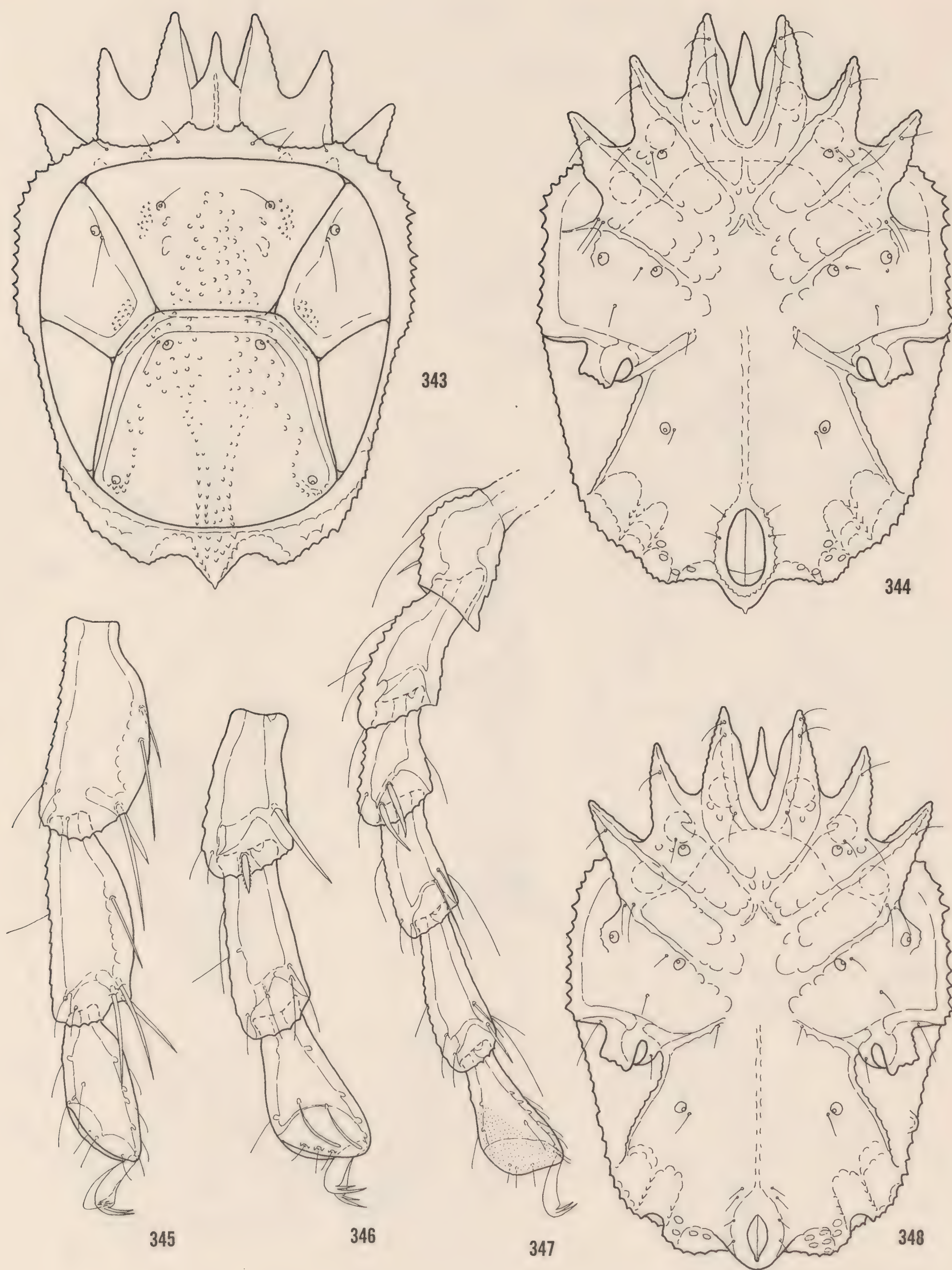


Neotryssaturus pallidus n. sp. Fig. 332, dorsal view, ♂; Fig. 333, ventral shield, ♀; Fig. 334, capitulum, ♀; Fig. 336, ventral shield, ♂.
Evidaturus exilis n. sp. Fig. 335, palp, ♀.



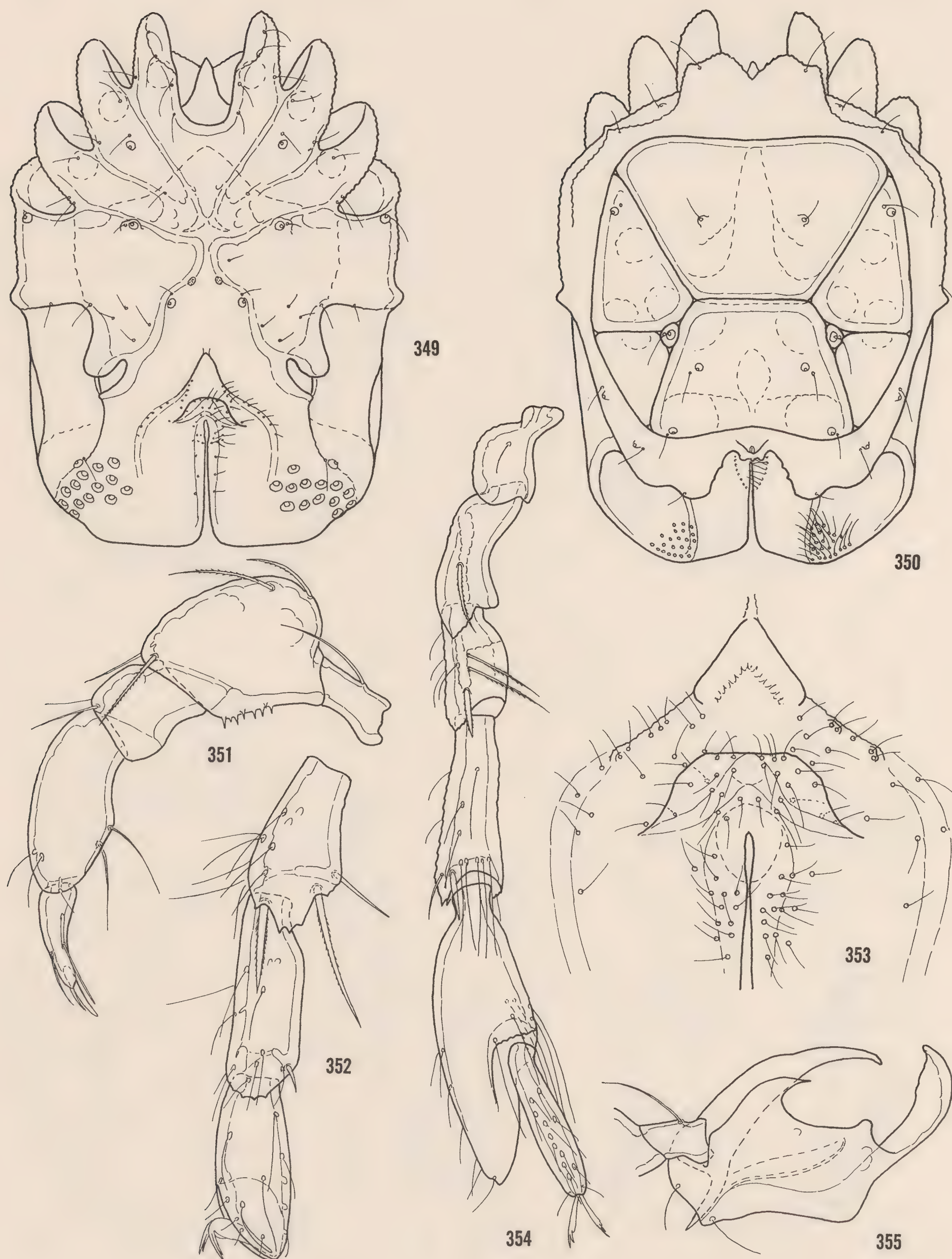
Evidaturus exilis n. sp. Fig. 337, ventral shield, ♂; Fig. 338, dorsal view, ♀; Fig. 340, fourth leg, ♂; Fig. 342, ventral shield, ♀.

Evidaturus scopticus n. sp. Fig. 339, capitulum and chelicera, ♂; Fig. 341, palp, ♀.

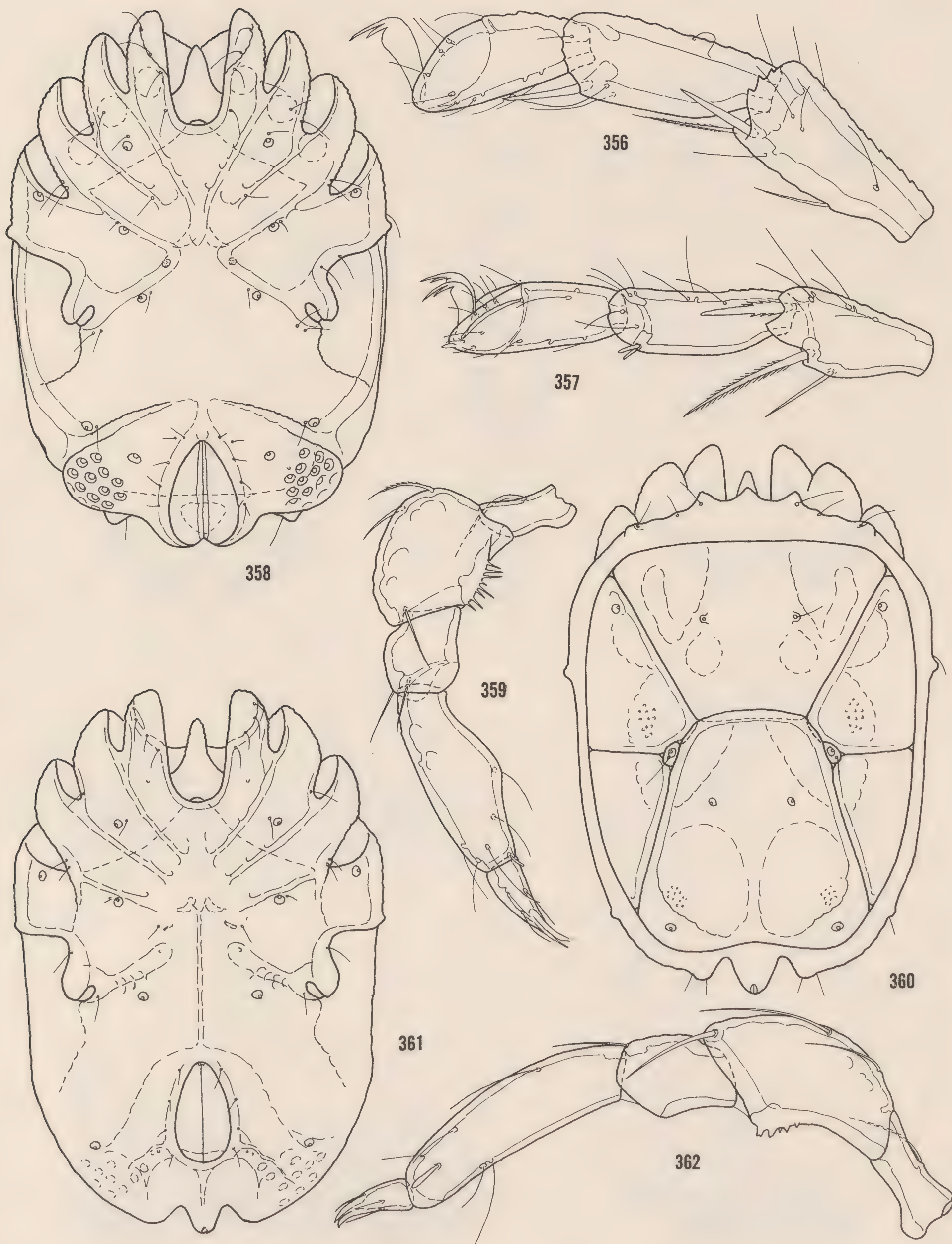


Evidaturus scopticus n. sp. Fig. 343, dorsal view, ♂; Fig. 344, ventral shield, ♀; Fig. 346, distal segments of first leg, ♀; Fig. 347, fourth leg, ♂; Fig. 348, ventral shield, ♂.

Piotaturus alvecaudatus n. sp. Fig. 345, distal segments of fourth leg, ♀.



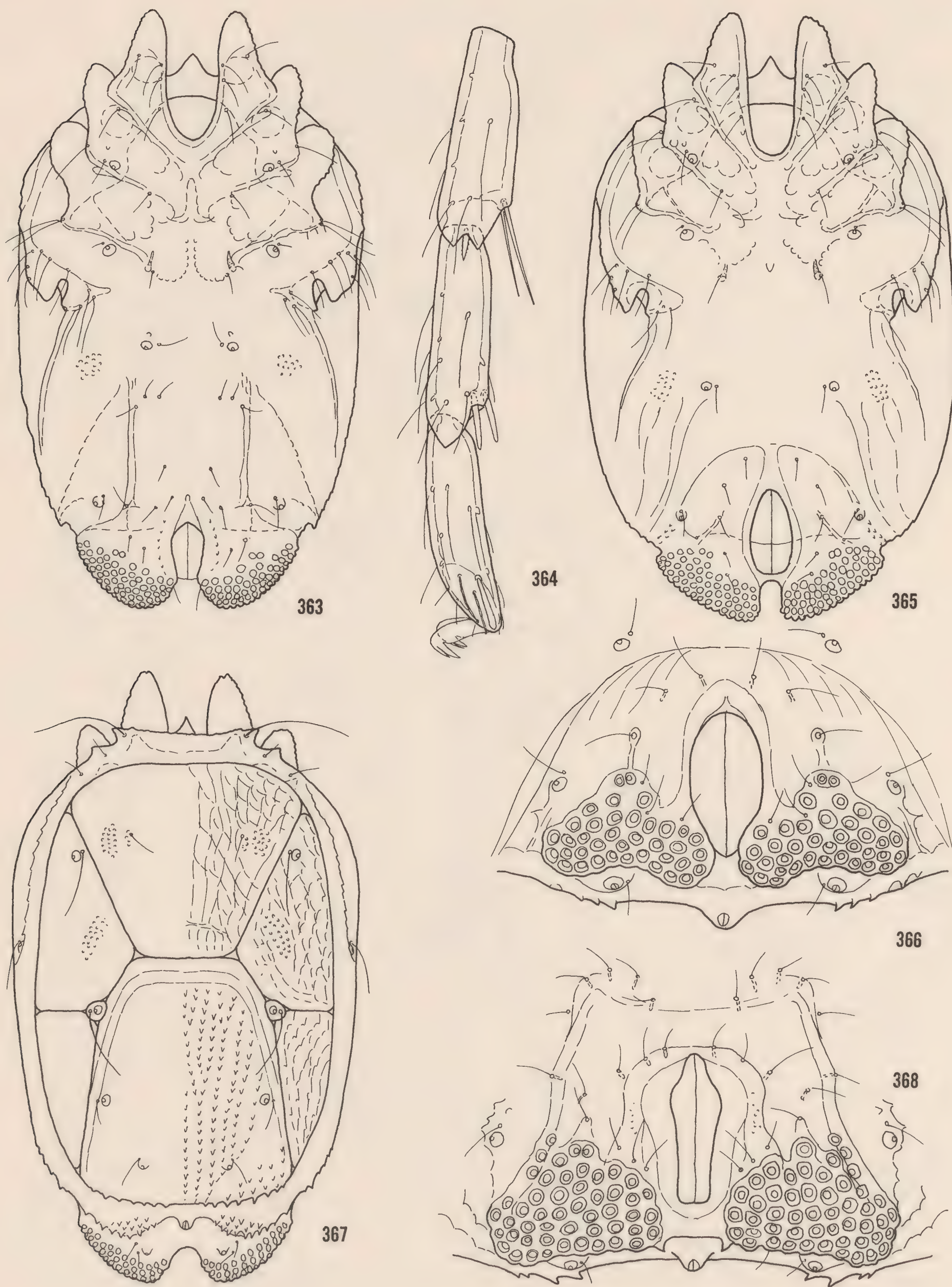
Piotaturus alvecaudatus n. sp. Fig. 349, ventral shield, ♂; Fig. 350, dorsal view, ♂; Fig. 351, palp, ♀; Fig. 352, distal segments of first leg, ♀; Fig. 353, posterior view of genital field region, ♂; Fig. 354, fourth leg, ♂; Fig. 355, capitulum and chelicera, ♀.



Piotaturus bovalus n. sp. (Female) Fig. 356, distal segments of fourth leg;
 Fig. 357, distal segments of first leg; Fig. 359, palp; Fig. 360, dorsal view;
 Fig. 361, ventral shield.

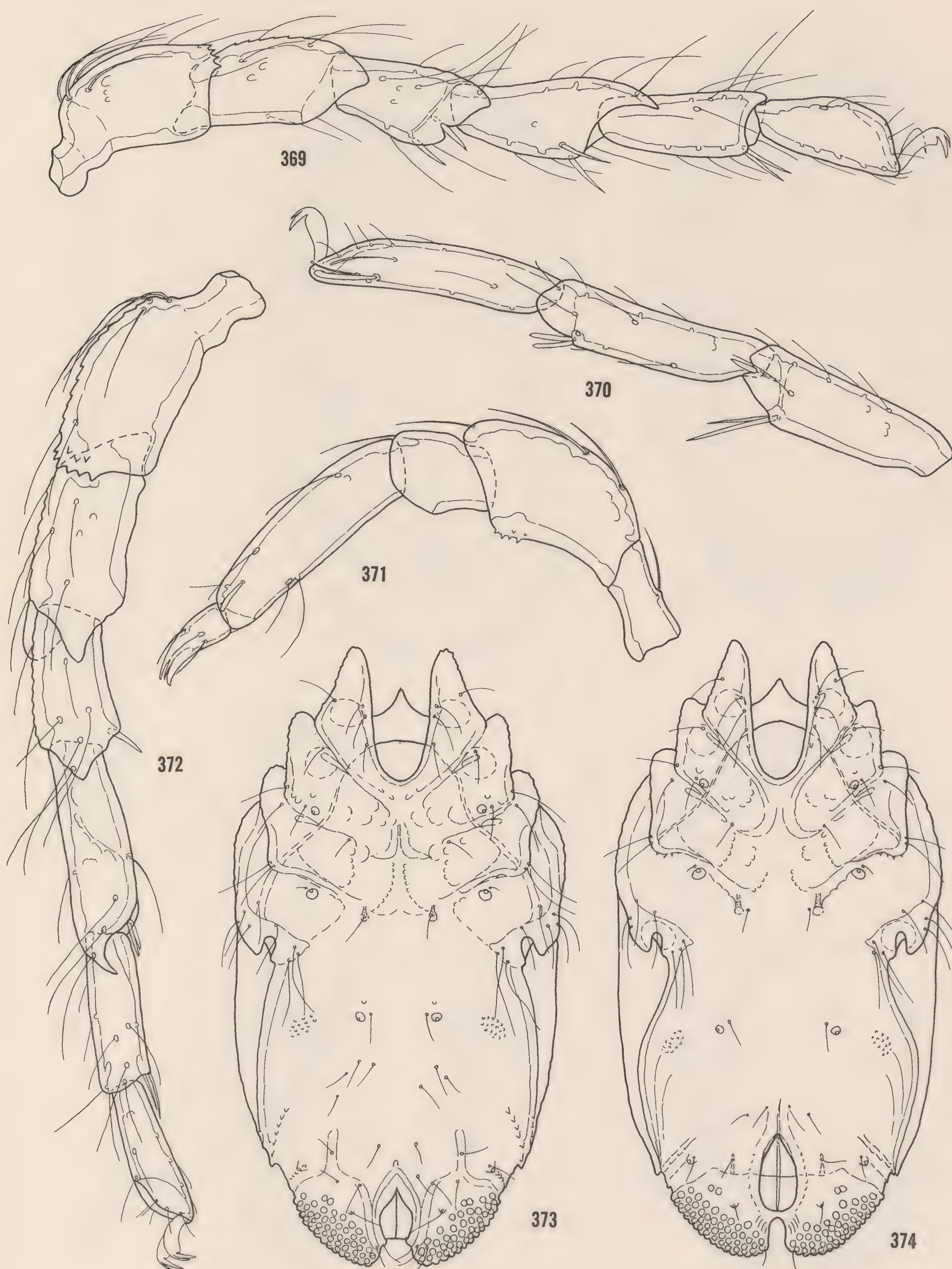
Piotaturus alvecaudatus n. sp. Fig. 358, ventral shield, ♀.

Pseudotryssaturus indentatus (Hopkins) Fig. 362, palp, ♀.



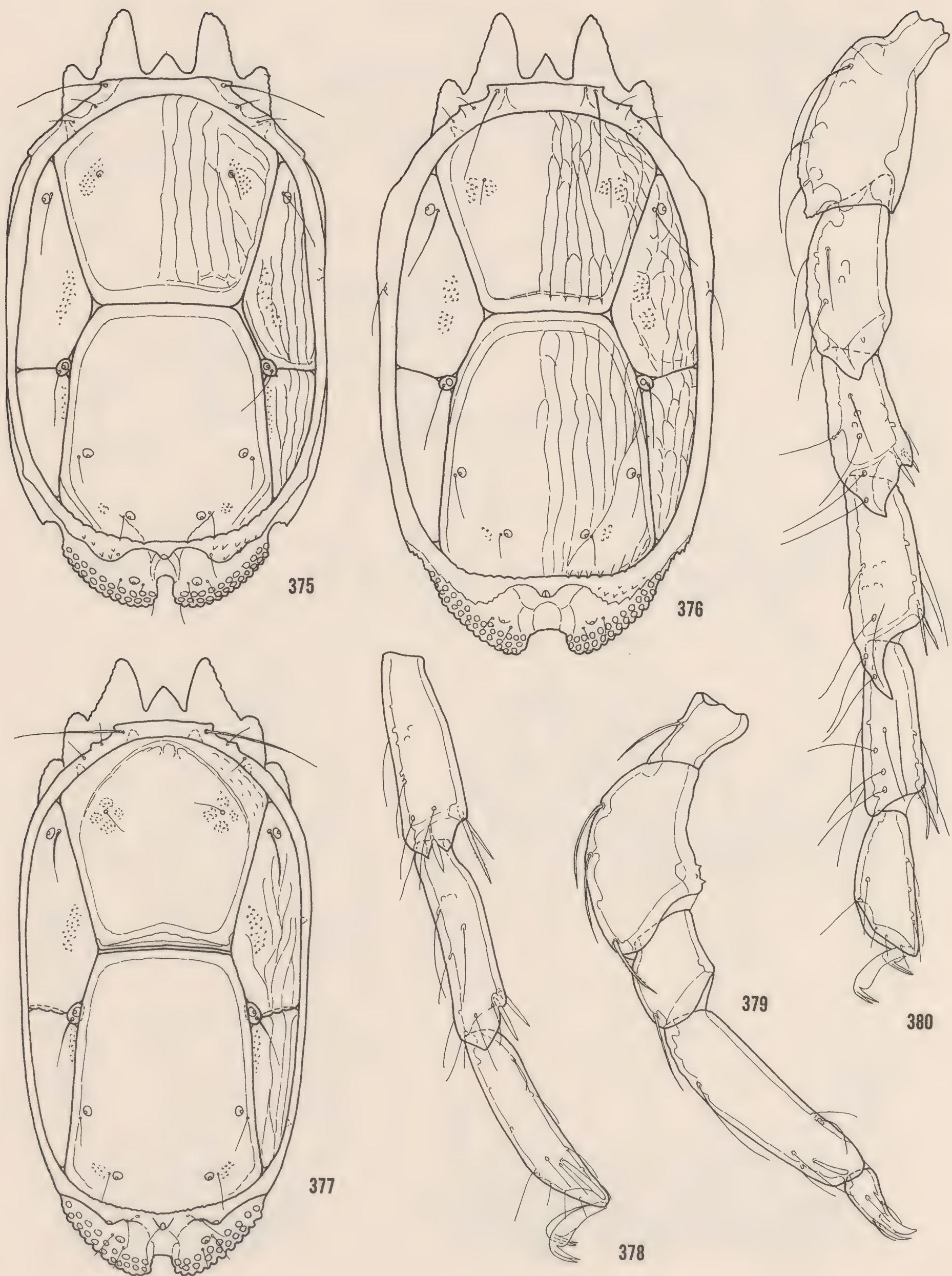
Pseudotryssaturus indentatus (Hopkins) Fig. 363, ventral shield, ♂; Fig. 364, distal segments of first leg, ♀; Fig. 365, ventral shield, ♀; Fig. 367, dorsal view, ♂.

Pseudotryssaturus anchistus n. sp. Fig. 366, posteroventral view of genital field, ♀; Fig. 368, posteroventral view of genital field, ♂.



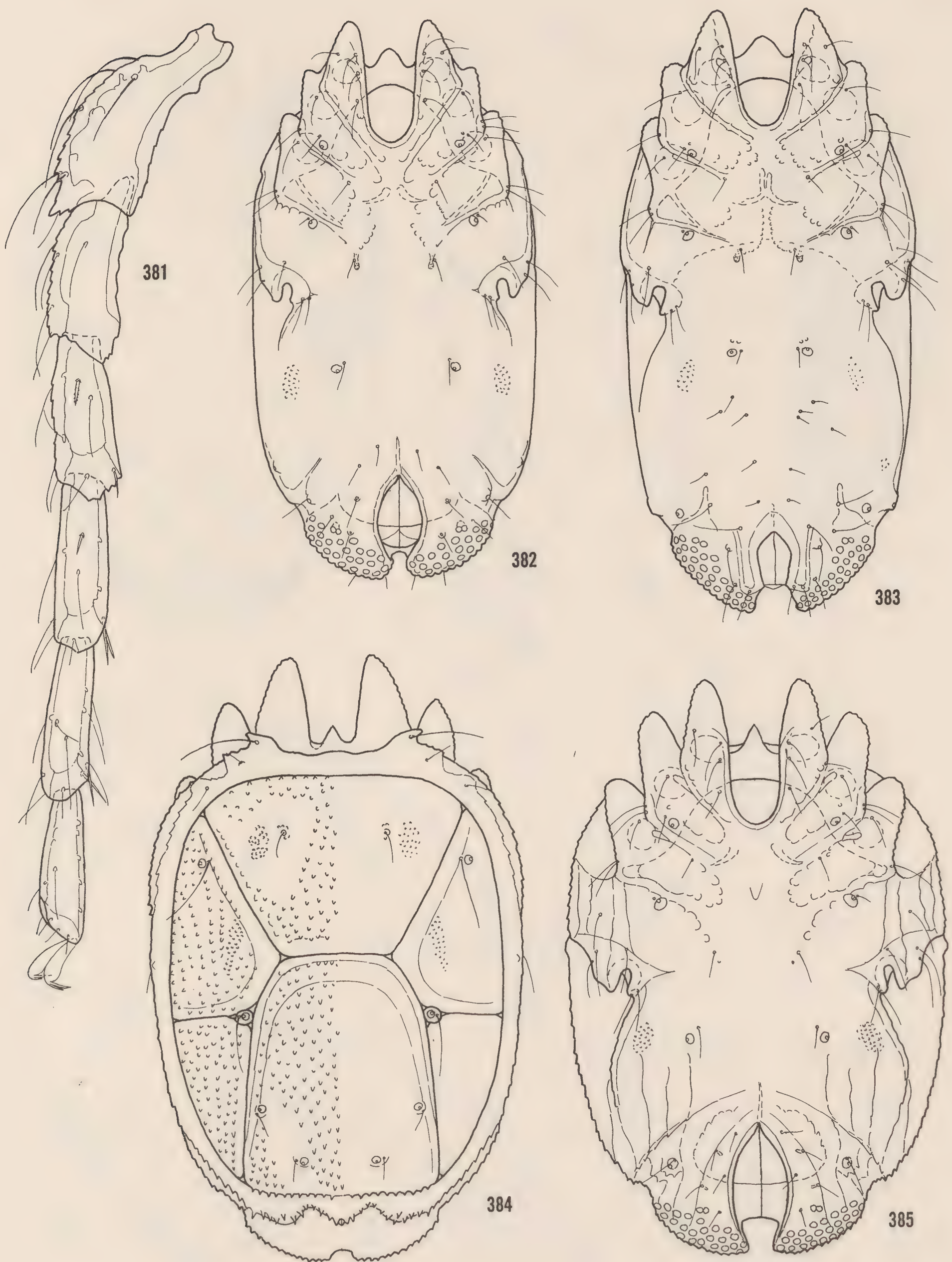
Pseudotryssaturus anchistus n. sp. Fig. 369, fourth leg, ♂; Fig. 370, distal segments of first leg, ♀; Fig. 371, palp, ♀; Fig. 373, ventral shield, ♂; Fig. 374, ventral shield, ♀.

Pseudotryssaturus indentatus (Hopkins) Fig. 372, fourth leg, ♂.



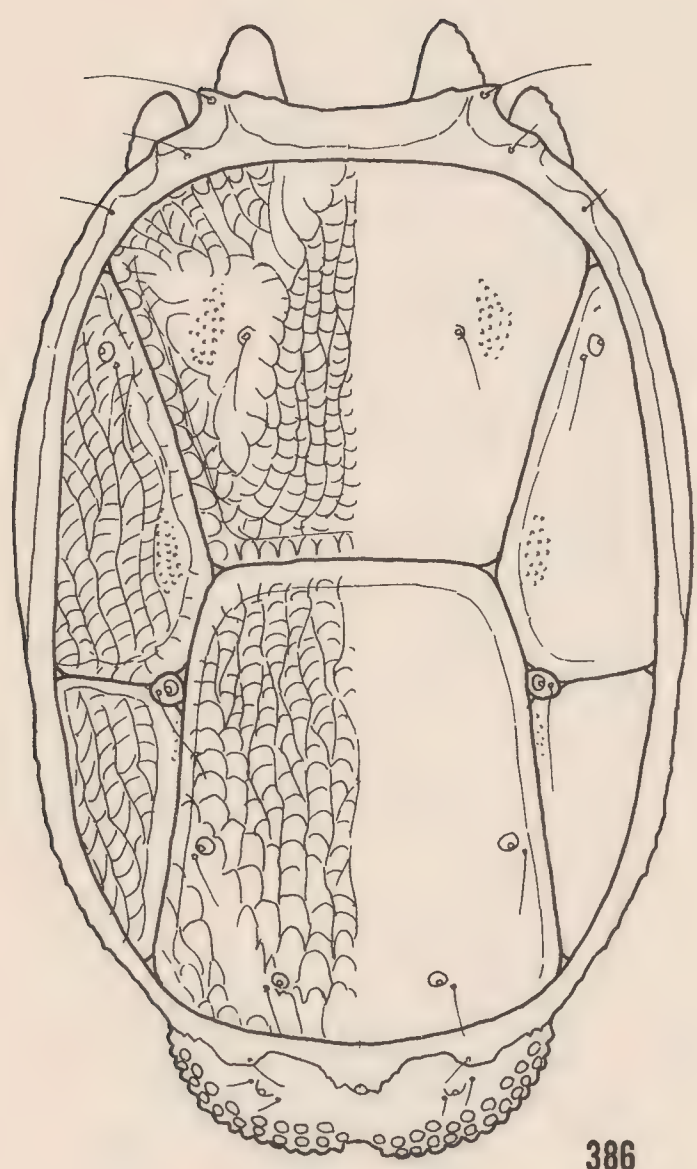
Pseudotryssaturus anchistus n. sp. Fig. 375, dorsal view, ♀; Fig. 376, dorsal view, ♂.

Pseudotryssaturus planus n. sp. Fig. 377, dorsal view, ♂; Fig. 378, distal segments of first leg, ♀; Fig. 379, palp; ♀; Fig. 380, fourth leg, ♂.



Pseudotryssaturus papillidermis n. sp. Fig. 381, fourth leg, ♂; Fig. 384, dorsal view, ♂; Fig. 385, ventral shield, ♀.

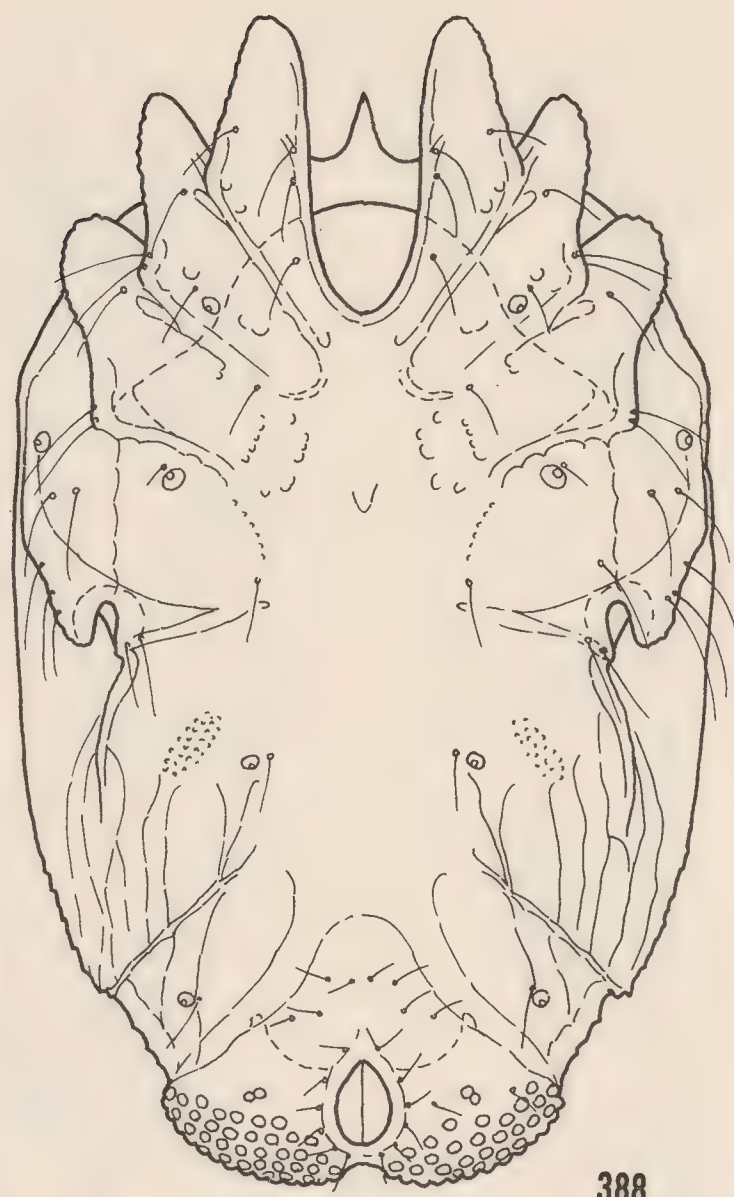
Pseudotryssaturus planus n. sp. Fig. 382, ventral shield, ♀; Fig. 383, ventral shield, ♂.



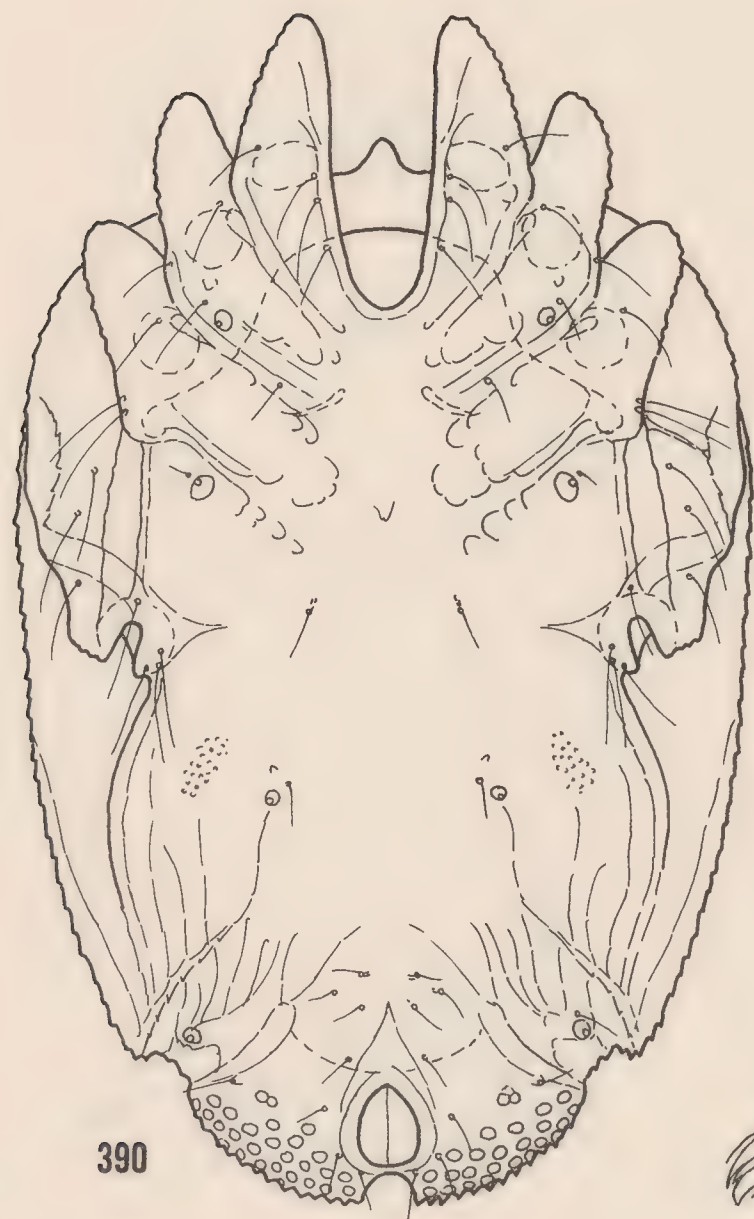
386



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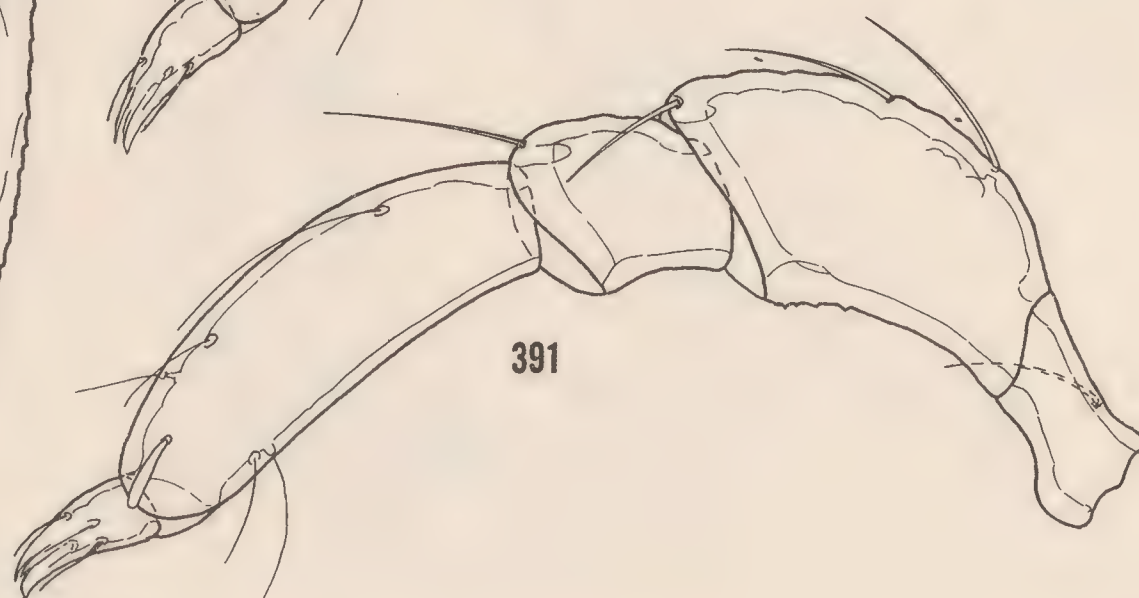
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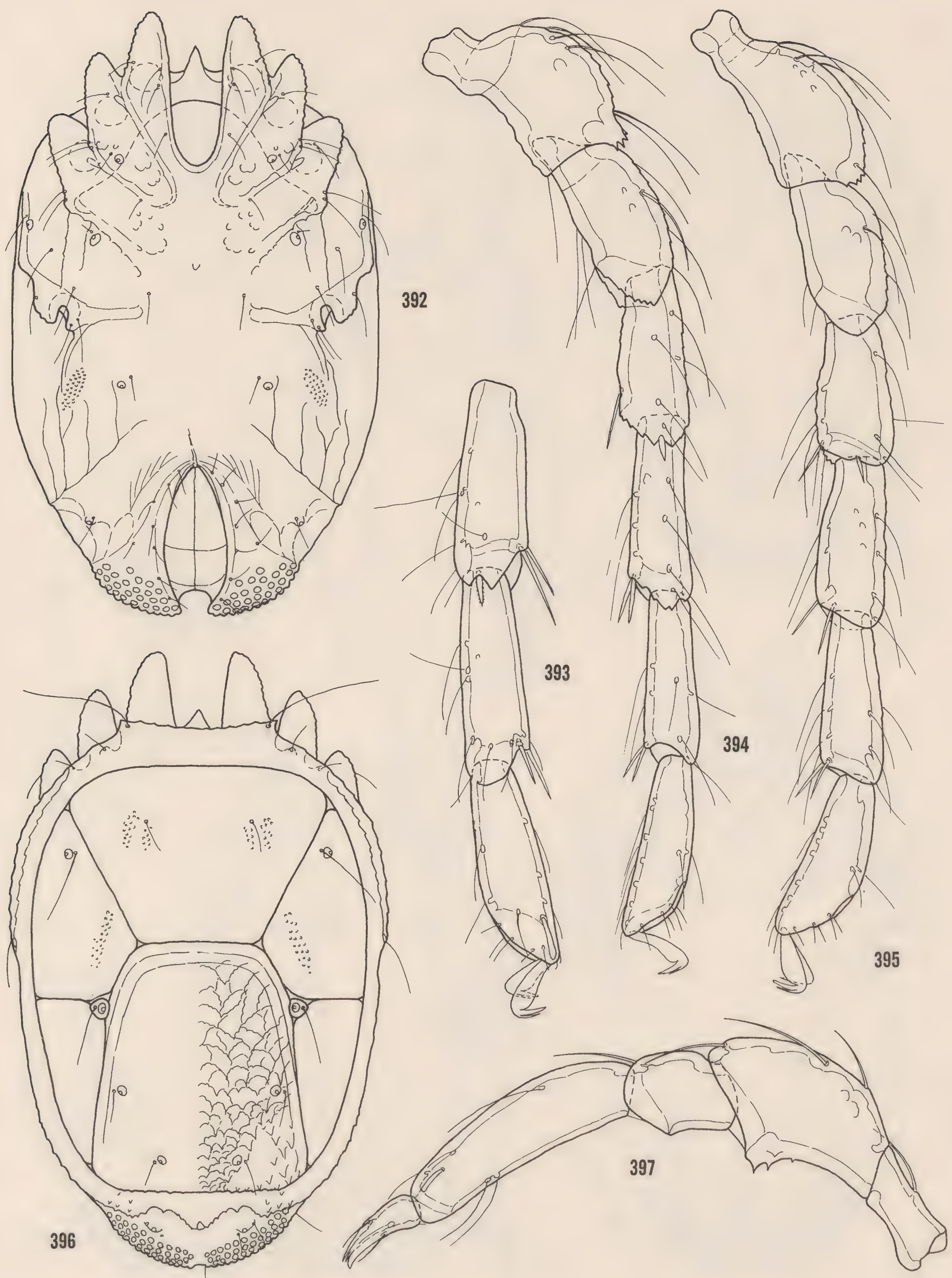
389



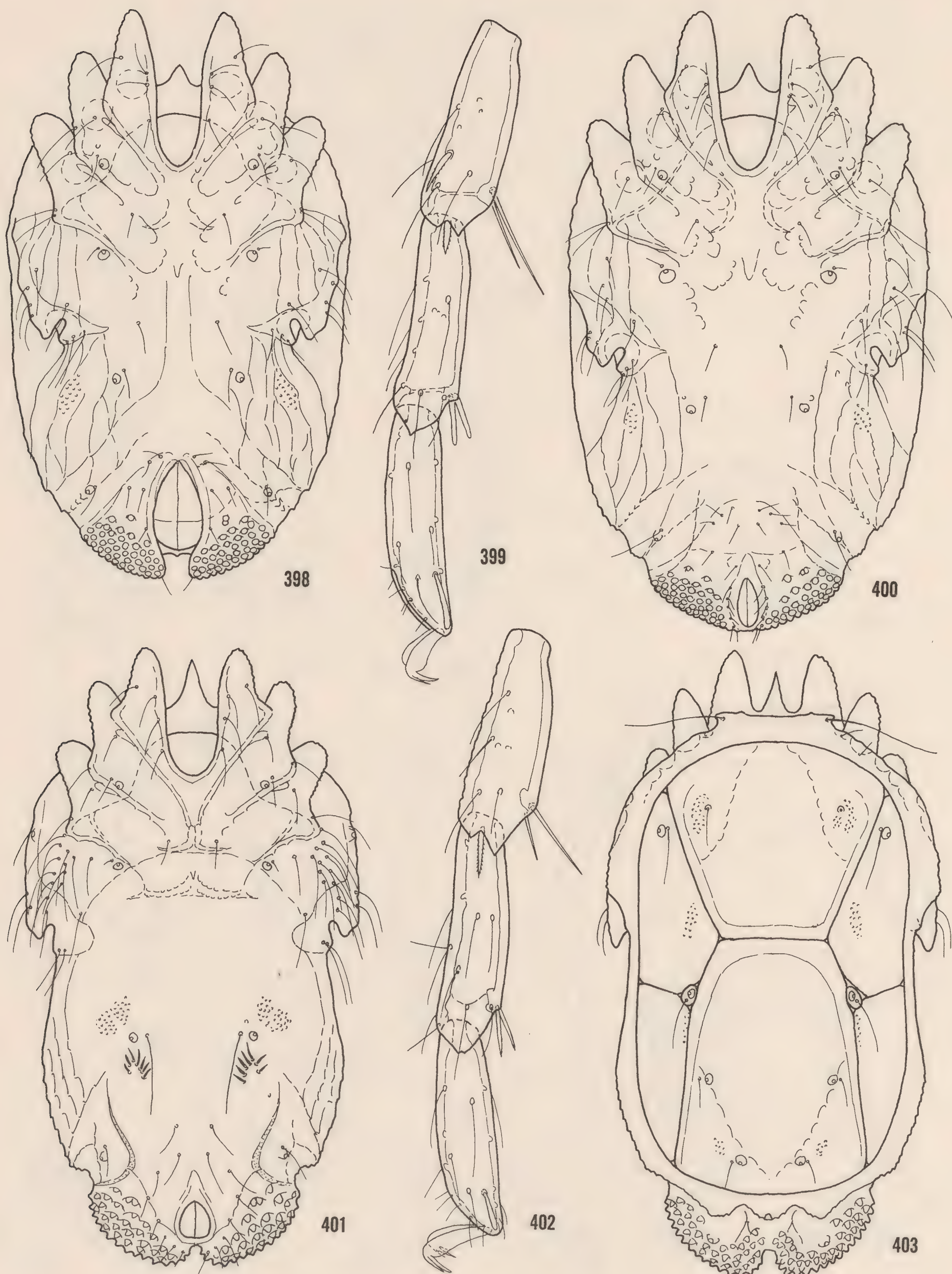
391

Pseudotryssaturus dictydermis n. sp. Fig. 386, dorsal view, ♂; Fig. 388, ventral shield, ♂; Fig. 391, palp, ♀.

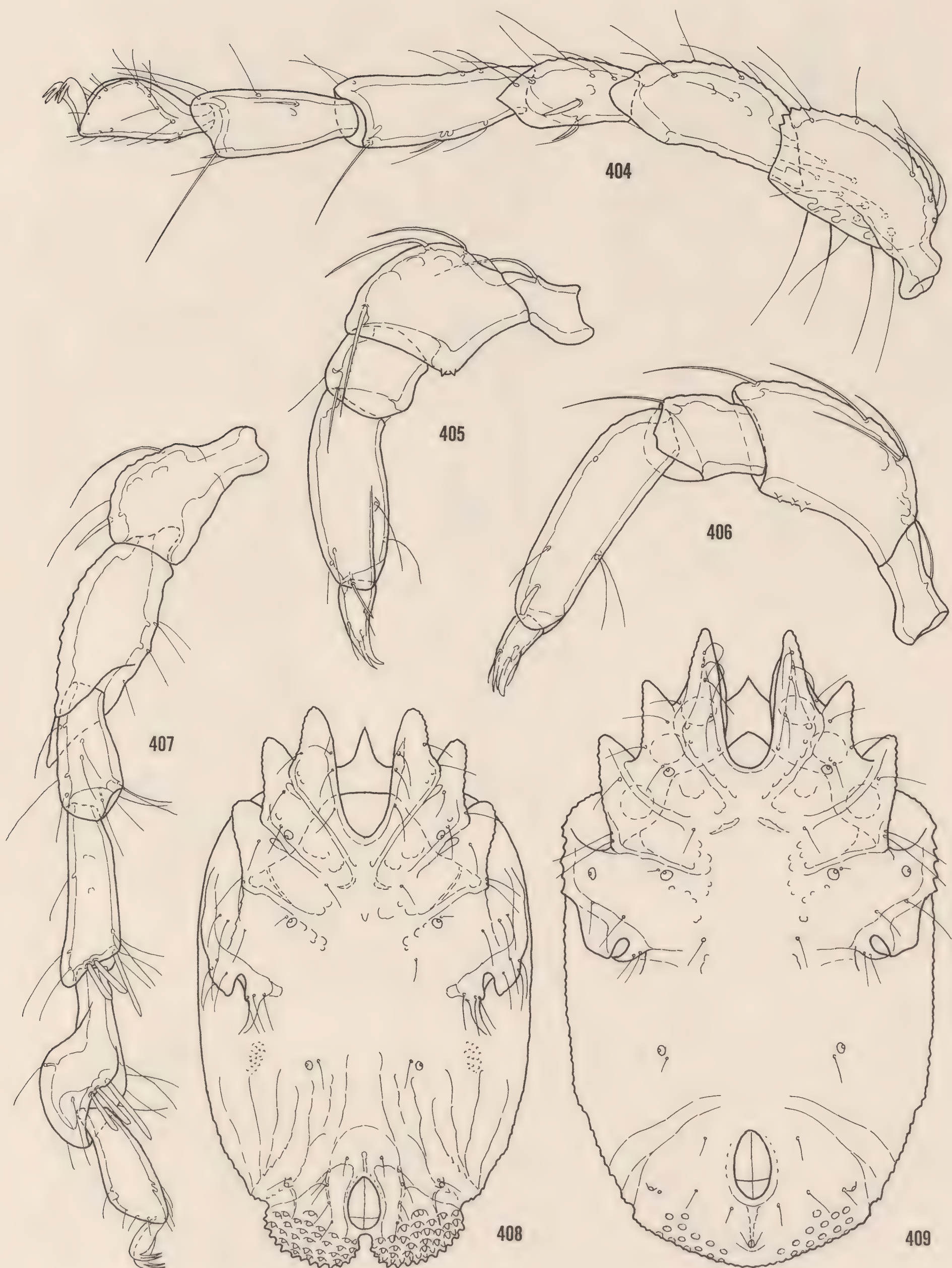
Pseudotryssaturus papillidermis n. sp. Fig. 387, distal segments of first leg, ♀; Fig. 389, palp, ♀; Fig. 390, ventral shield, ♂.



Pseudotryssaturus dictydermis n. sp. Fig. 392, ventral shield, ♀; Fig. 393, distal segments of first leg, ♀; Fig. 395, fourth leg, ♂.
Pseudotryssaturus acutus n. sp. Fig. 394, fourth leg, ♂; Fig. 396, dorsal view, ♂; Fig. 397, palp, ♀.

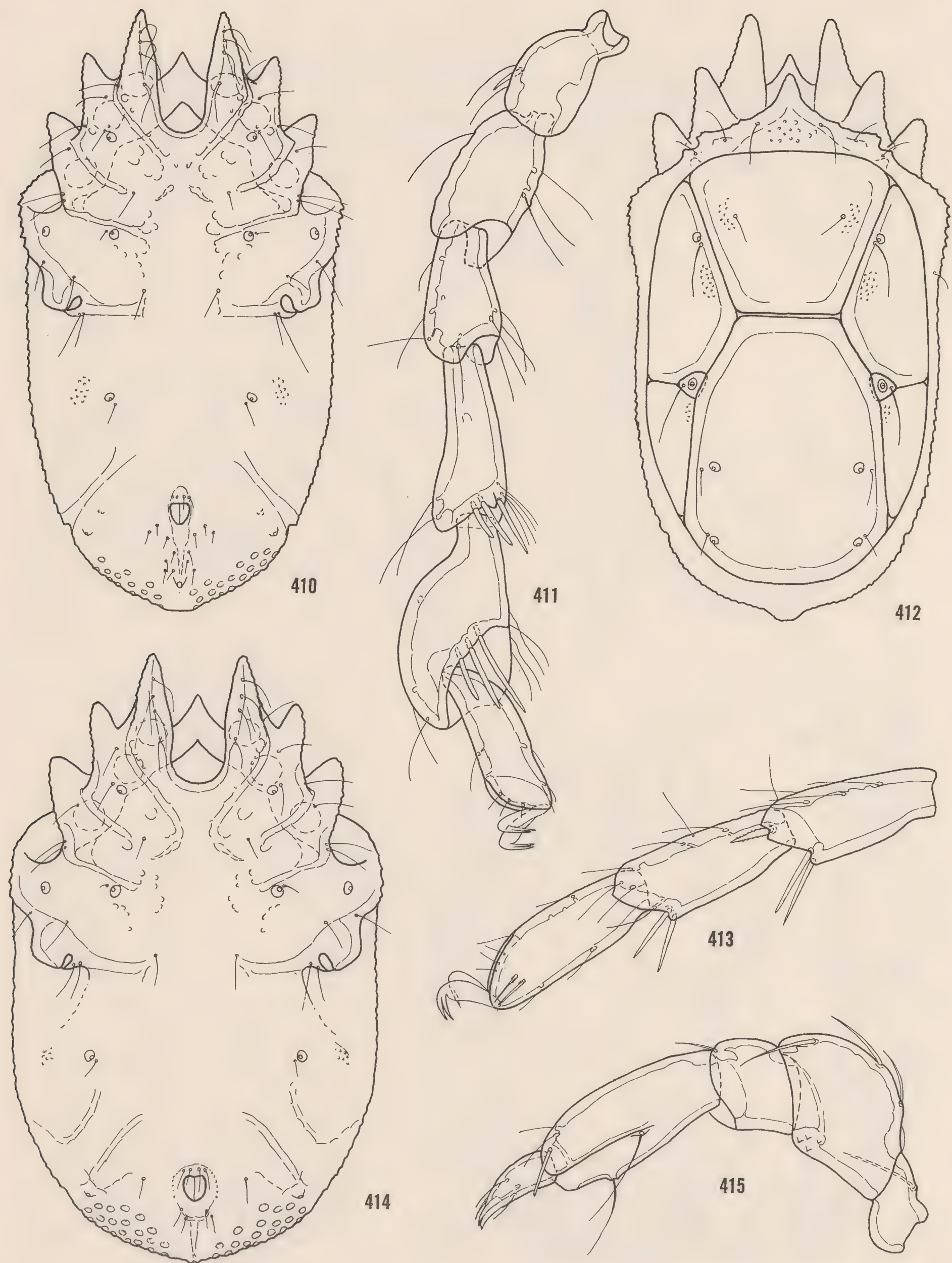


Pseudotryssaturus acutus n. sp. Fig. 398, ventral shield, ♀; Fig. 399, distal segments of first leg, ♀; Fig. 400, ventral shield, ♂.
Pseudotryssaturus dapsilus n. sp. Fig. 401, ventral shield, ♂; Fig. 402, distal segments of first leg, ♀; Fig. 403, dorsal view, ♂.

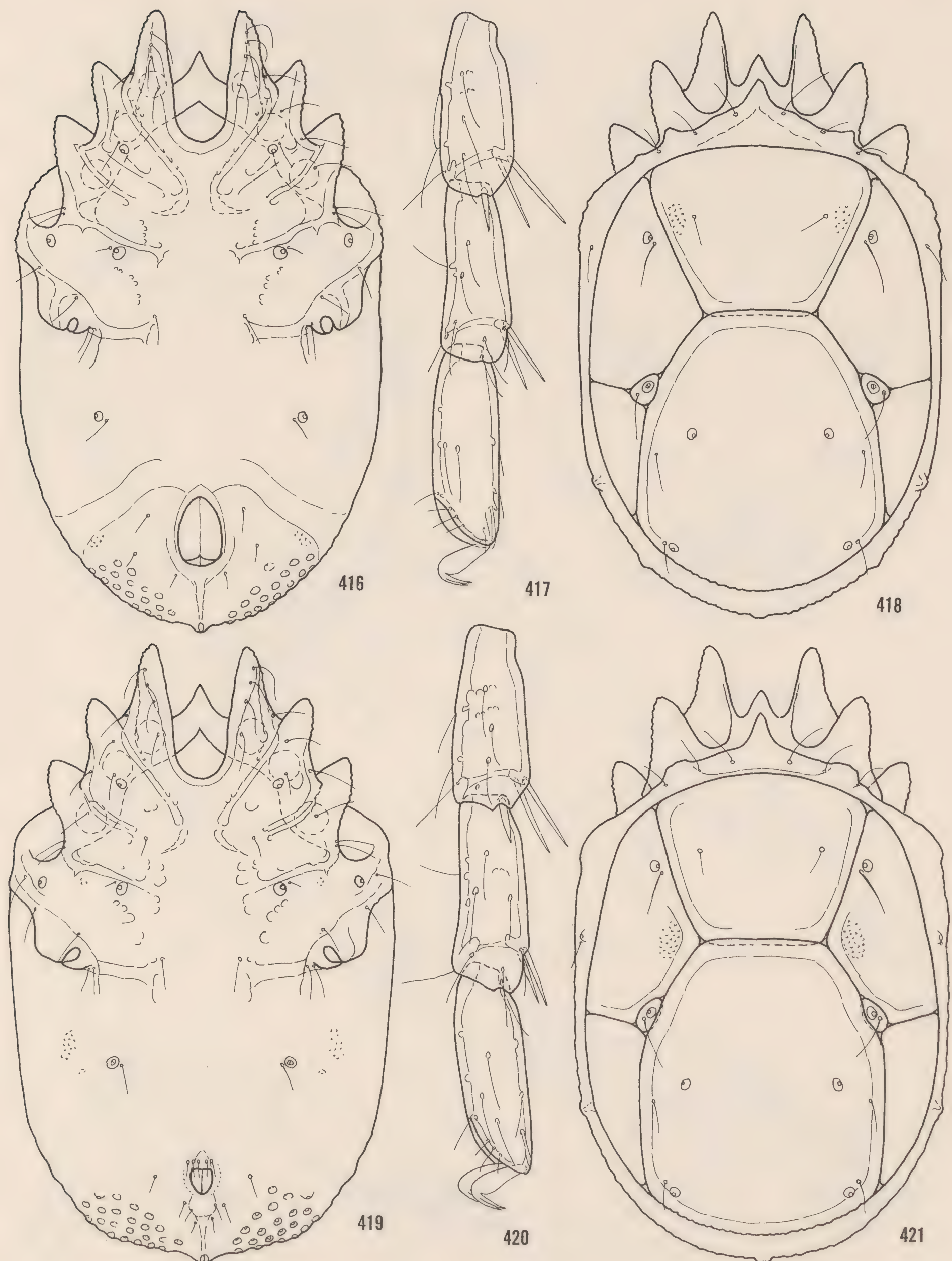


Pseudotryssaturus dapsilus n. sp. Fig. 404, fourth leg, ♂; Fig. 406, palp, ♀;
Fig. 408, ventral shield, ♀.

Paratryssaturus cantermus n. sp. Fig. 405, palp, ♀; Fig. 407, fourth leg, ♂;
Fig. 409, ventral shield, ♀.

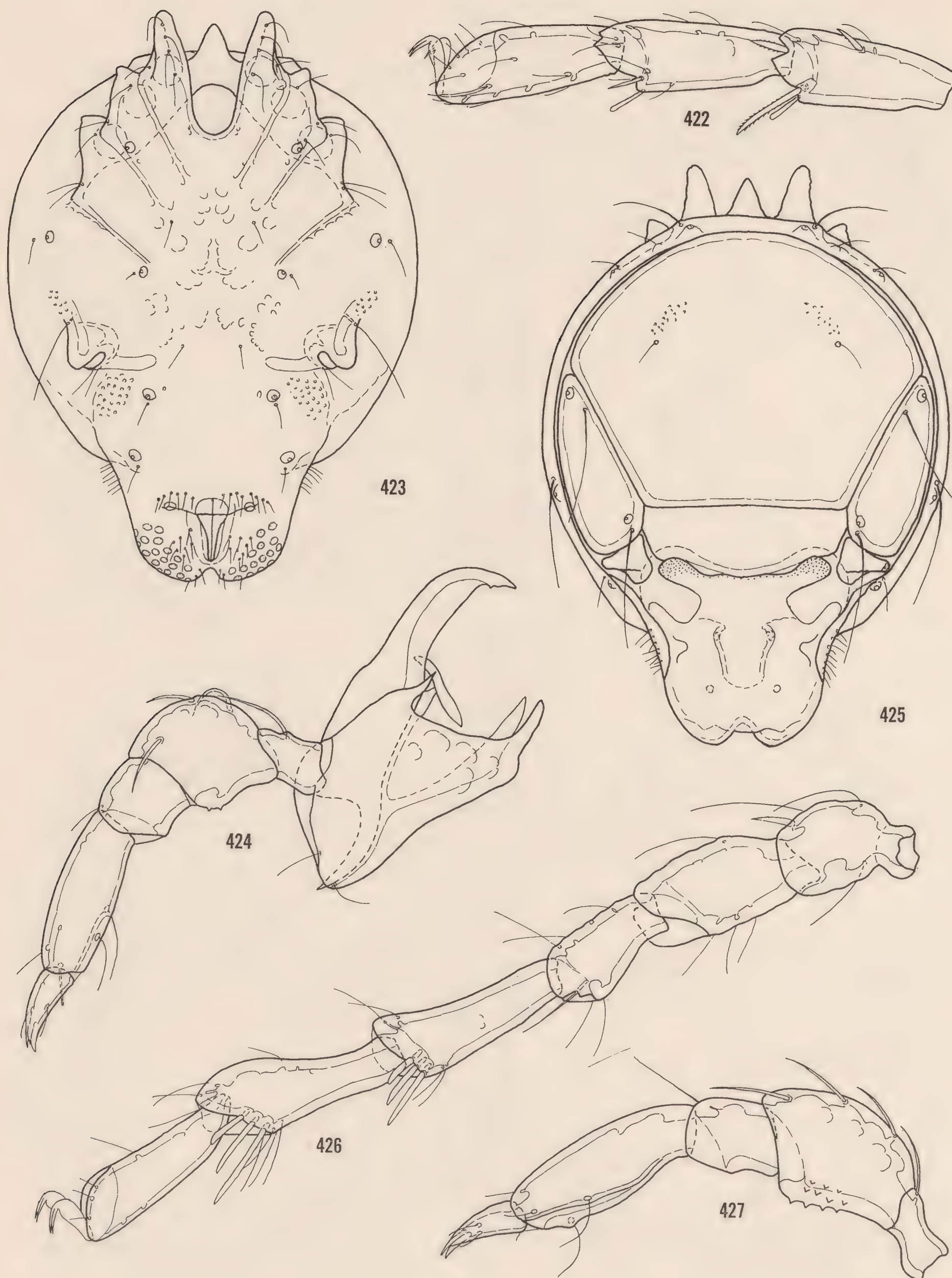


Paratryssaturus cantermus n. sp. Fig. 410, ventral shield, ♂; Fig. 412, dorsal view, ♂; Fig. 413, distal segments of first leg, ♀.
Paratryssaturus minutus (Hopkins) Fig. 411, fourth leg, ♂; Fig. 414, ventral shield, ♂; Fig. 415, palp, ♀.



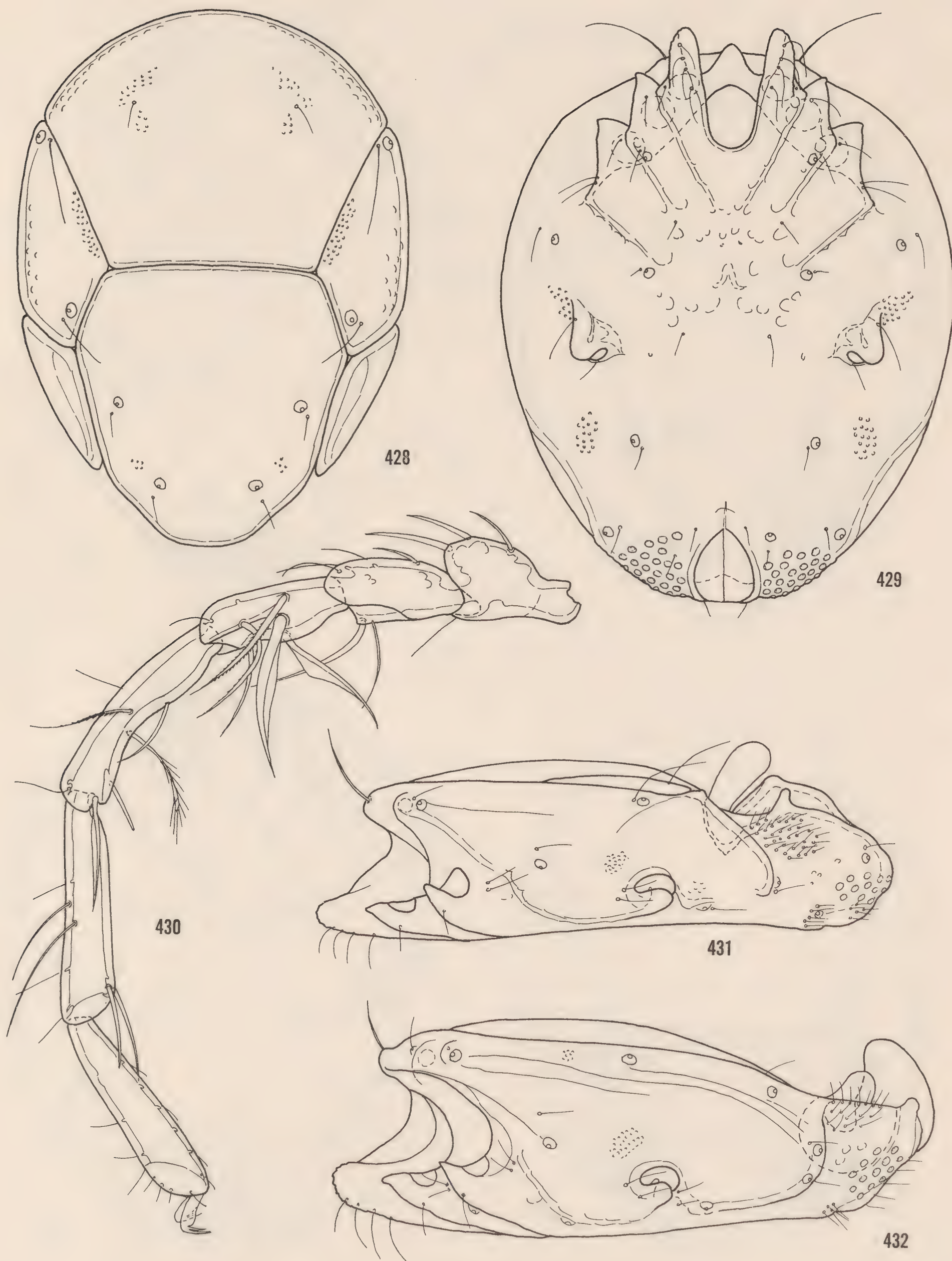
Paratryssaturus minutus (Hopkins) Fig. 416, ventral shield, ♀; Fig. 417, distal segments of first leg, ♀; Fig. 418, dorsal view, ♂.

Paratryssaturus zodelus n. sp. Fig. 419, ventral shield, ♂; Fig. 420, distal segments of first leg, ♂; Fig. 421, dorsal view, ♂.

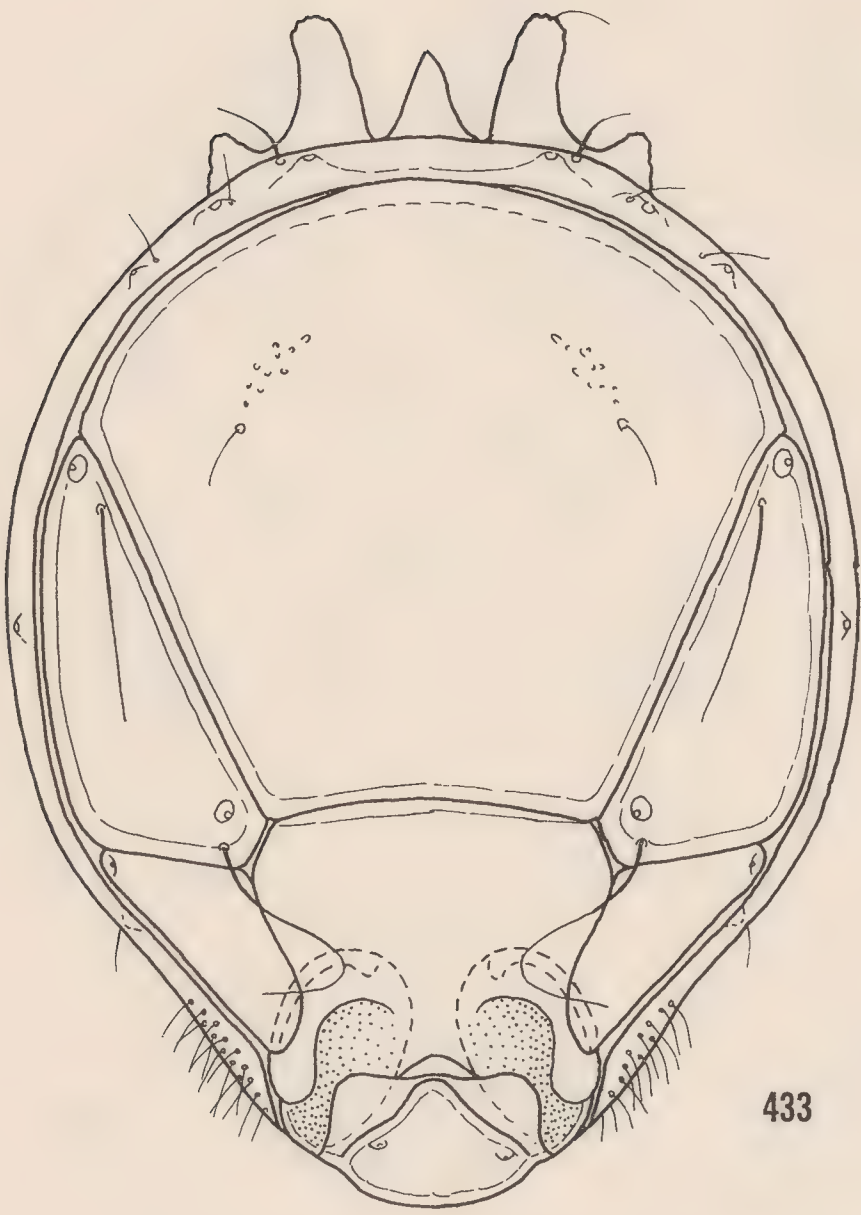


Kritaturus jacundus n. sp. Fig. 422, distal segments of first leg, ♀; Fig. 423, ventral shield, ♂; Fig. 425, dorsal view, ♂; Fig. 427, palp, ♀.

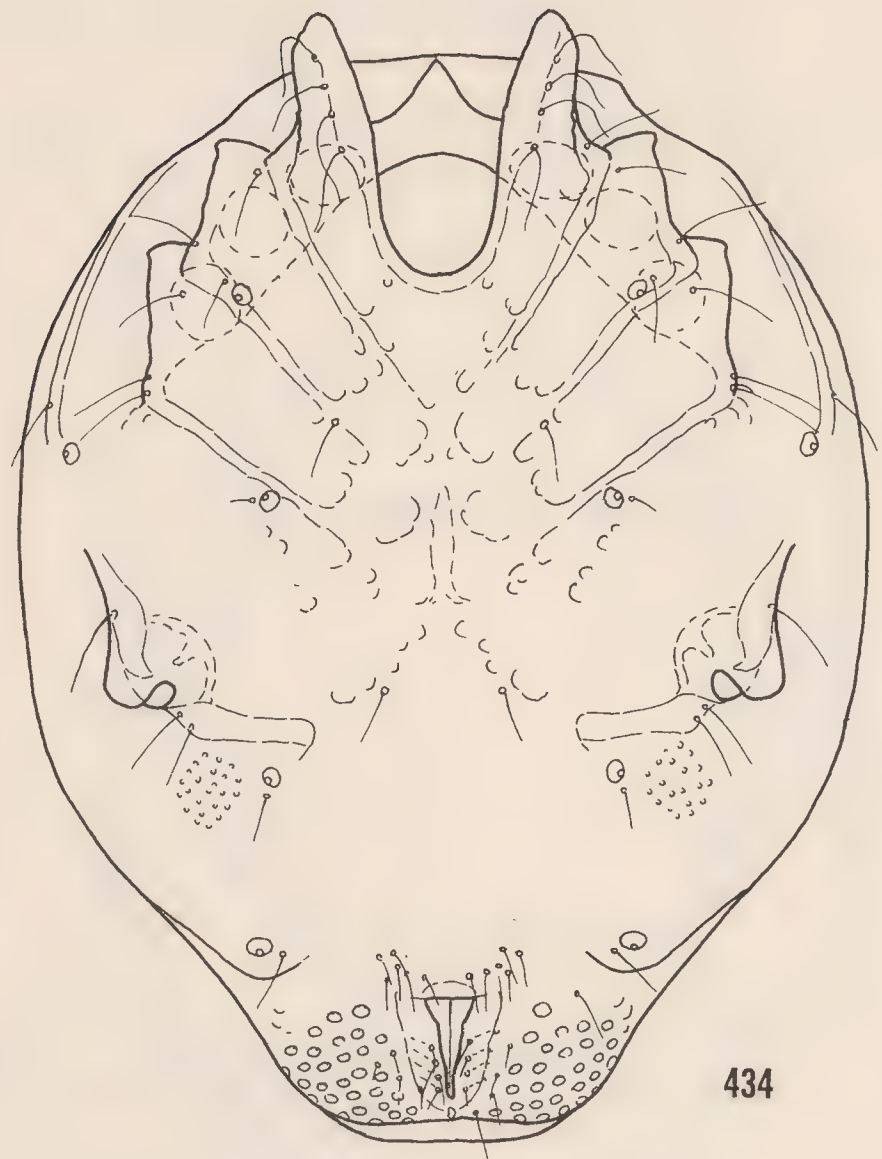
Paratryssaturus zodelus n. sp. Fig. 424, lateral view of capitulum, chelicera and palp, ♂; Fig. 426, fourth leg, ♂.



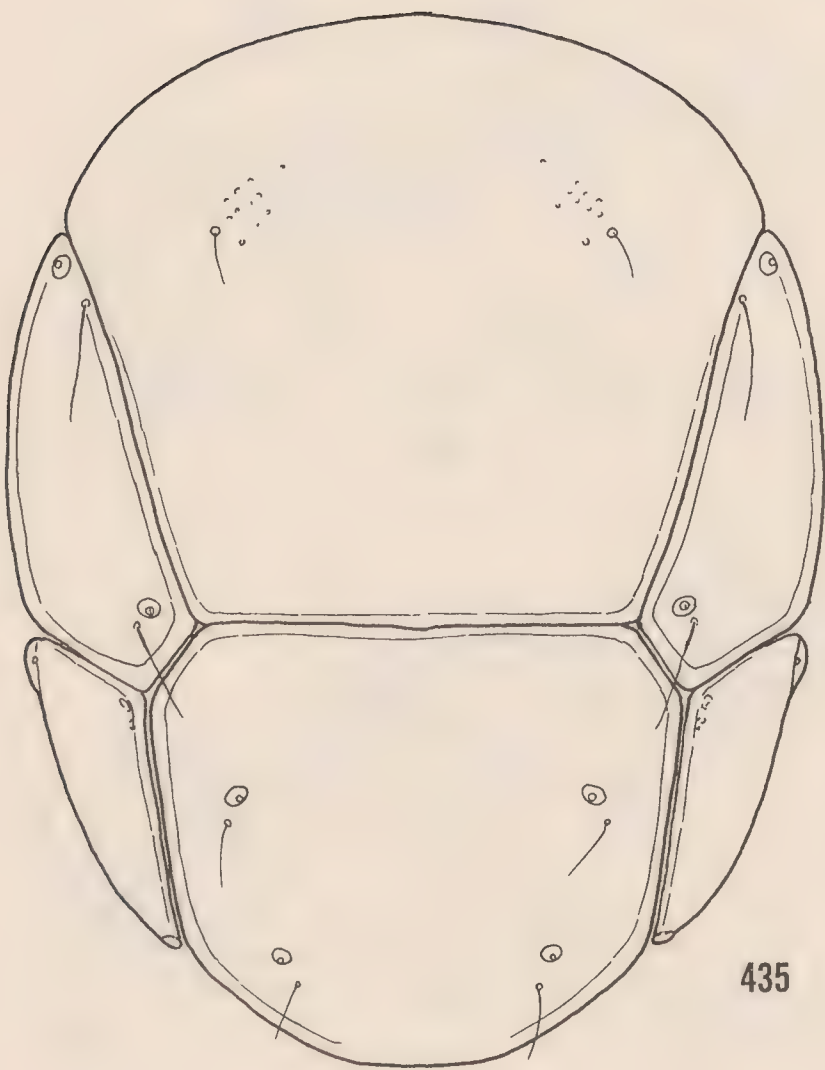
Kritaturus jacundus n. sp. Fig. 428, dorsal shield, ♀; Fig. 429, ventral shield, ♀; Fig. 430, fourth leg, ♂; Fig. 431, lateral view, ♂.
Kritaturus tenonus n. sp. Fig. 432, lateral view, ♂.



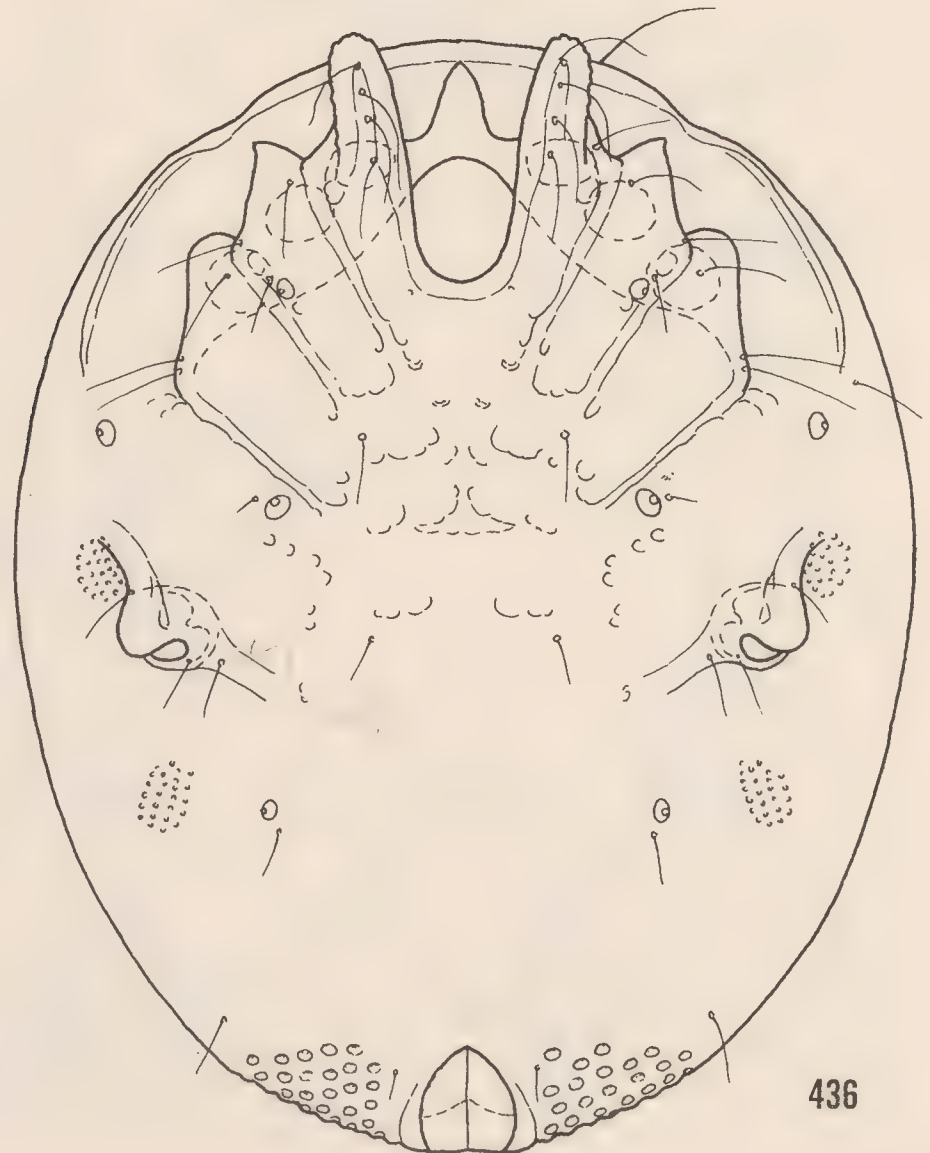
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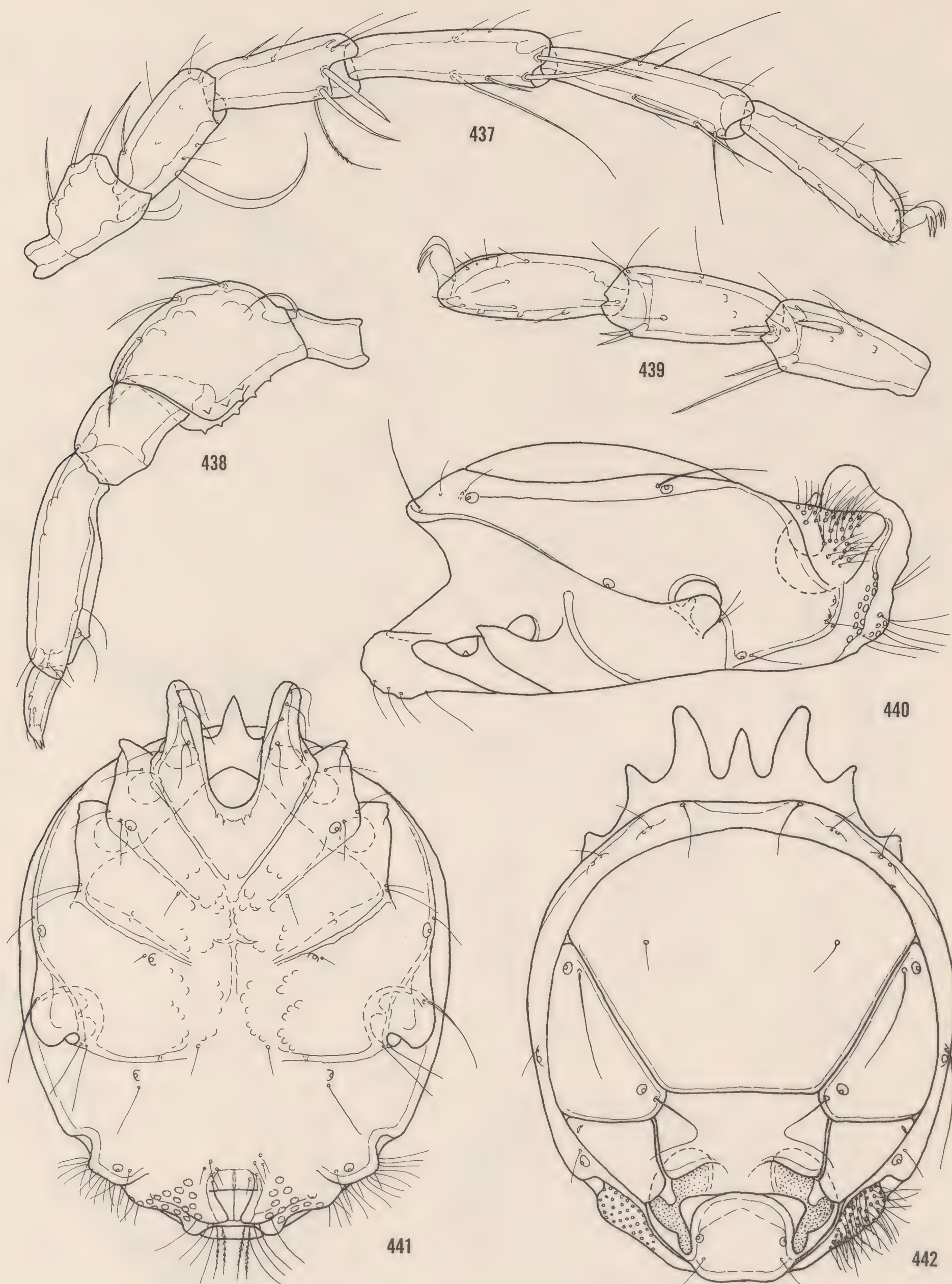


435



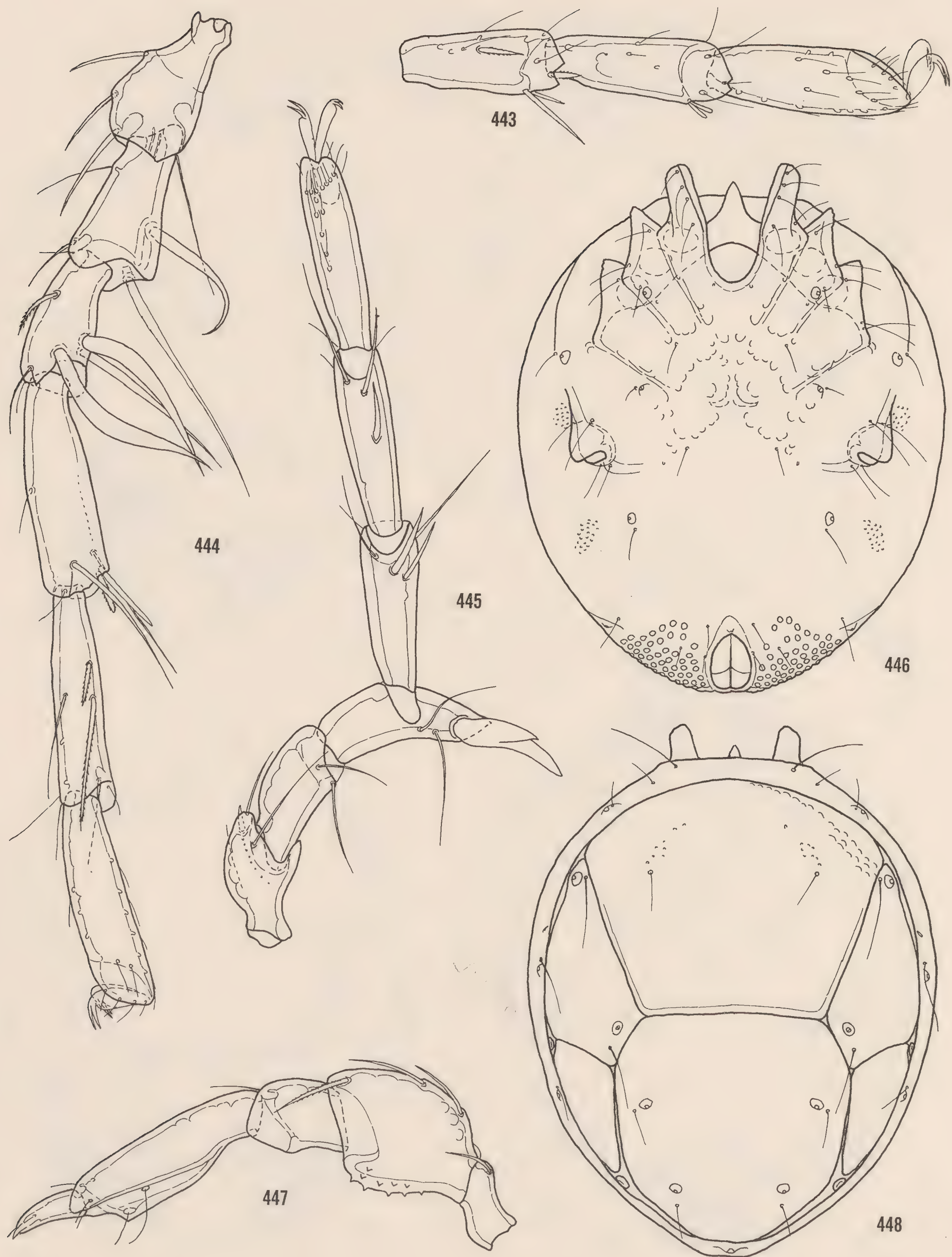
436

Kritaturus tenonus n. sp. Fig. 433, dorsal view, ♂; Fig. 434, ventral shield, ♂; Fig. 435, dorsal shield, ♀; Fig. 436, ventral shield, ♀.



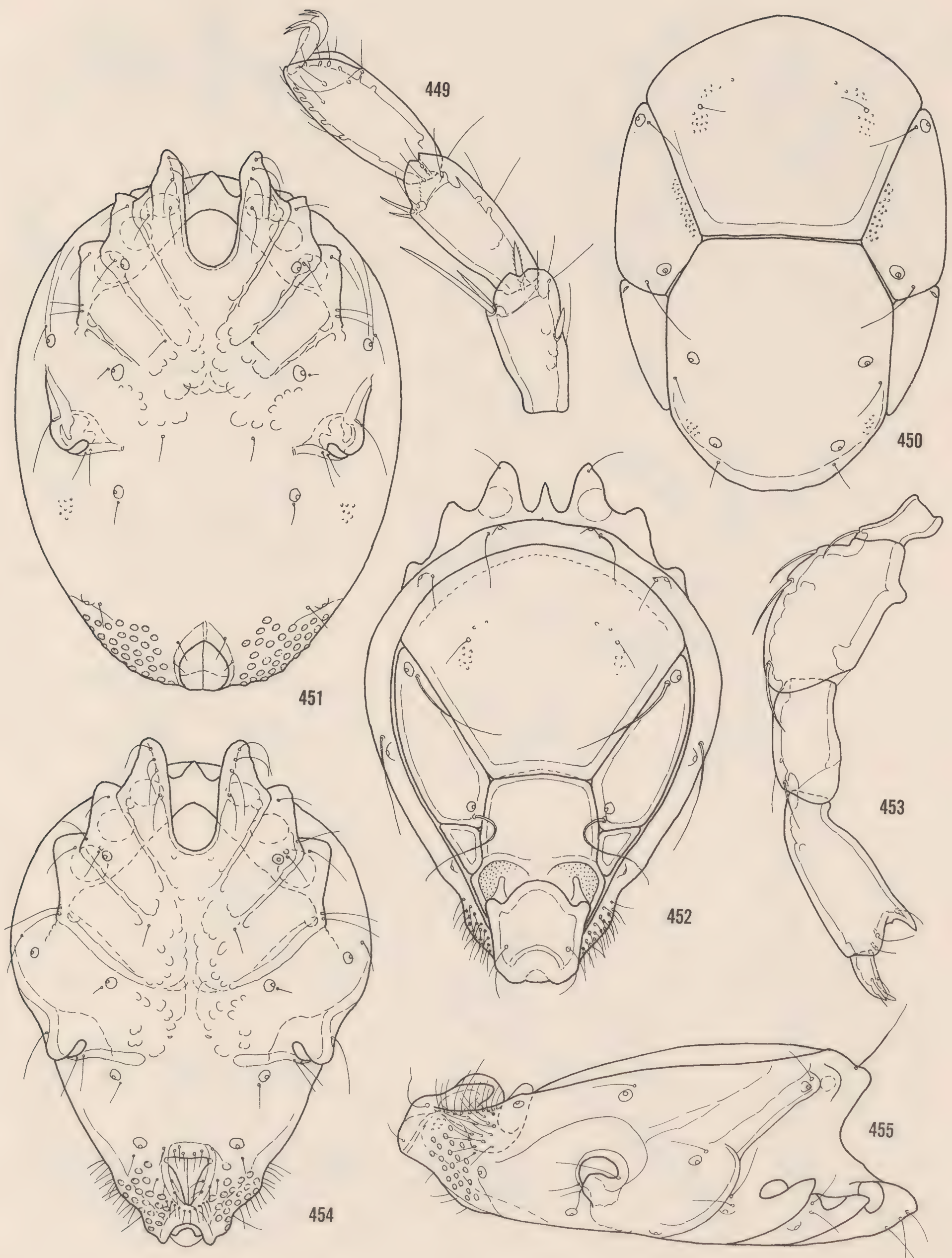
Kritaturus tenonus n. sp. Fig. 437, fourth leg, ♂; Fig. 438, palp, ♀; Fig. 439, distal segments of first leg, ♀.

Kritaturus rucabus n. sp. Fig. 440, lateral view, ♂; Fig. 441, ventral shield, ♂; Fig. 442, dorsal view, ♂.

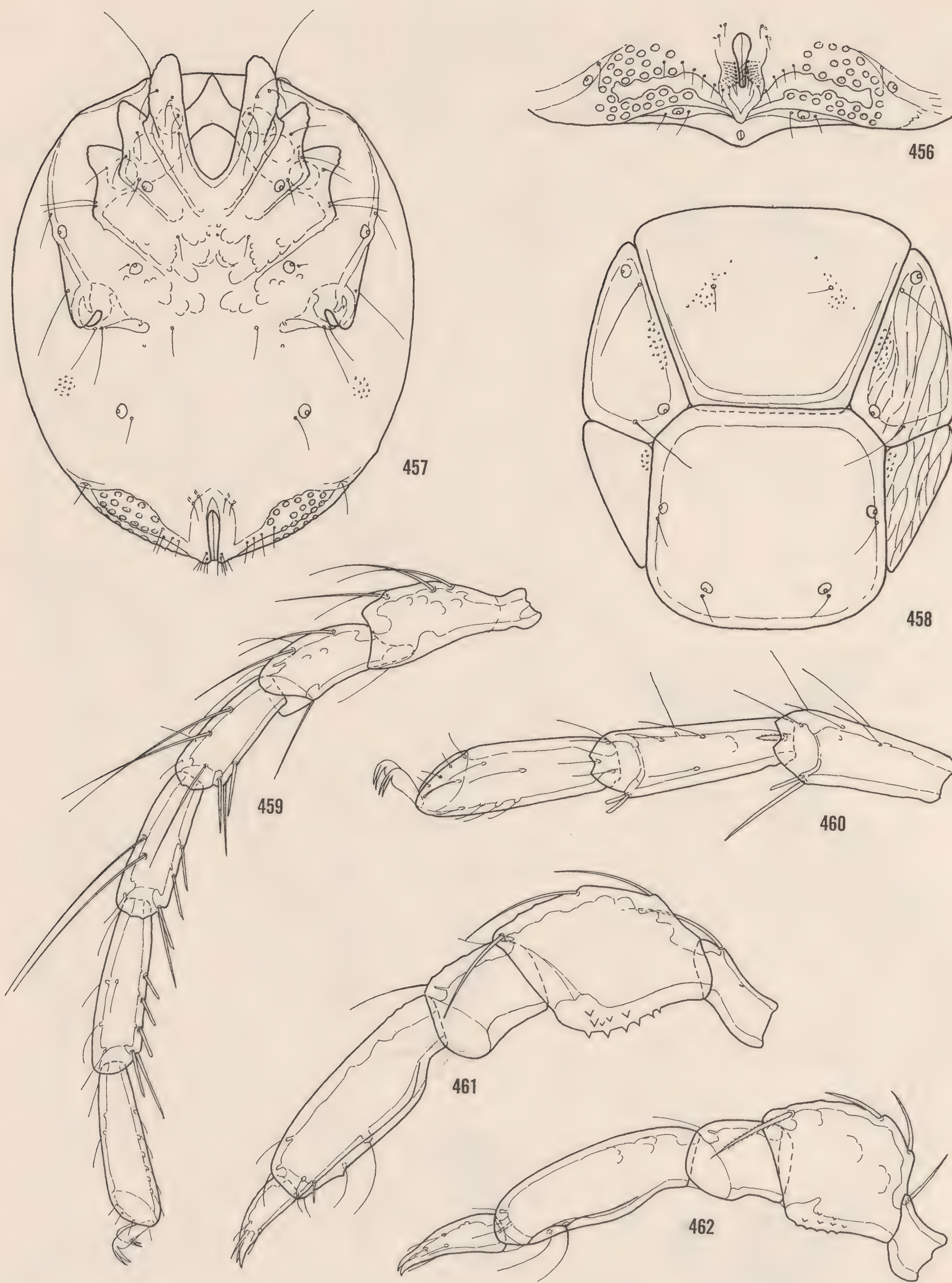


Kritaturus rucabus n. sp. Fig. 443, distal segments of first leg, ♂; Fig. 444, fourth leg, ♂; Fig. 446, ventral shield, ♀; Fig. 447, palp, ♂; Fig. 448, dorsal view, ♀.

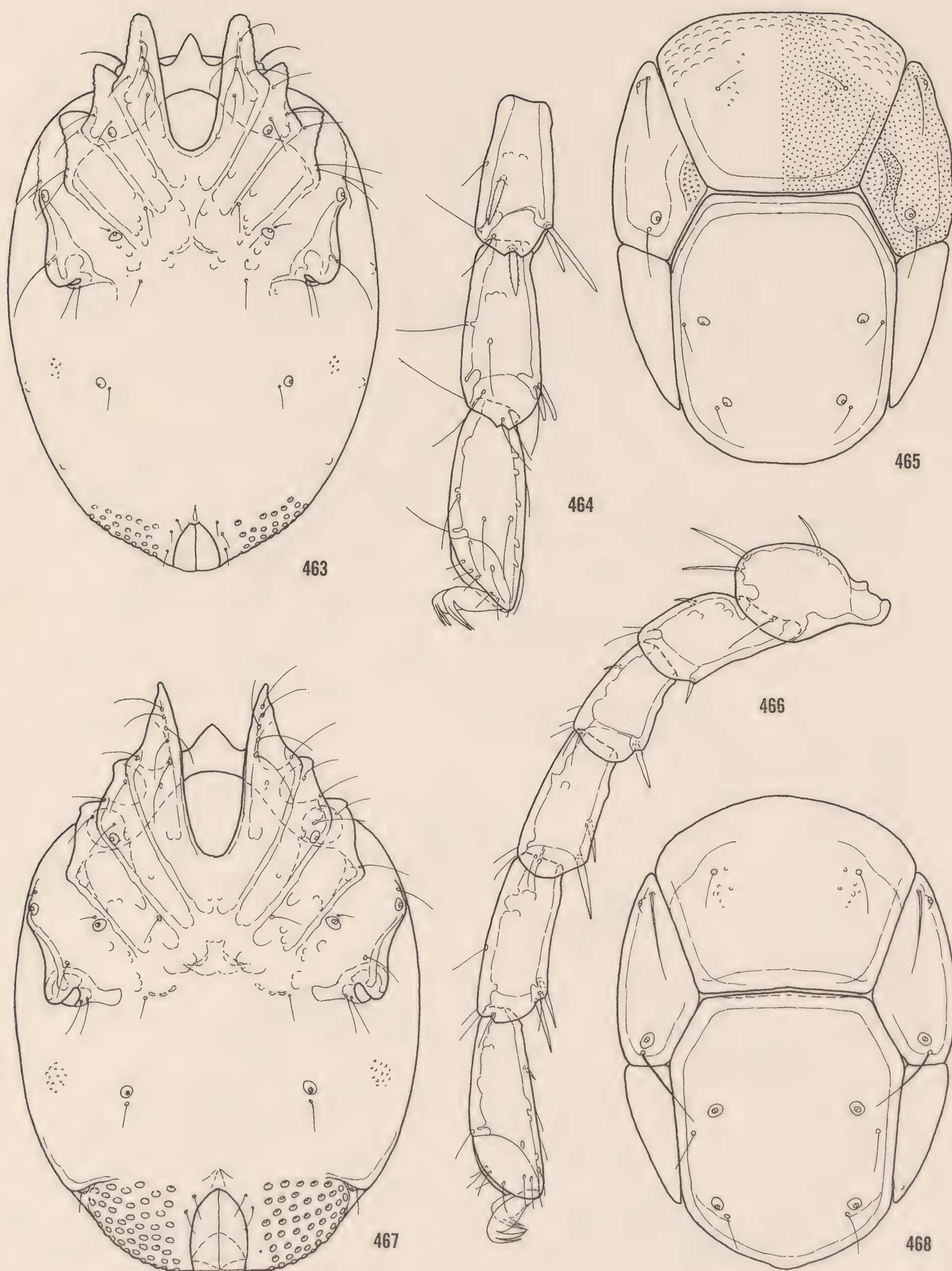
Kritaturus uncipalpis n. sp. Fig. 445, fourth leg, ♂.



Kritaturus uncipalpis n. sp. Fig. 449, distal segments of first leg, ♀; Fig. 450, dorsal shield, ♀; Fig. 451, ventral shield, ♀; Fig. 452, dorsal view, ♂; Fig. 453, palp, ♀; Fig. 454, ventral shield, ♂; Fig. 455, lateral view, ♂.

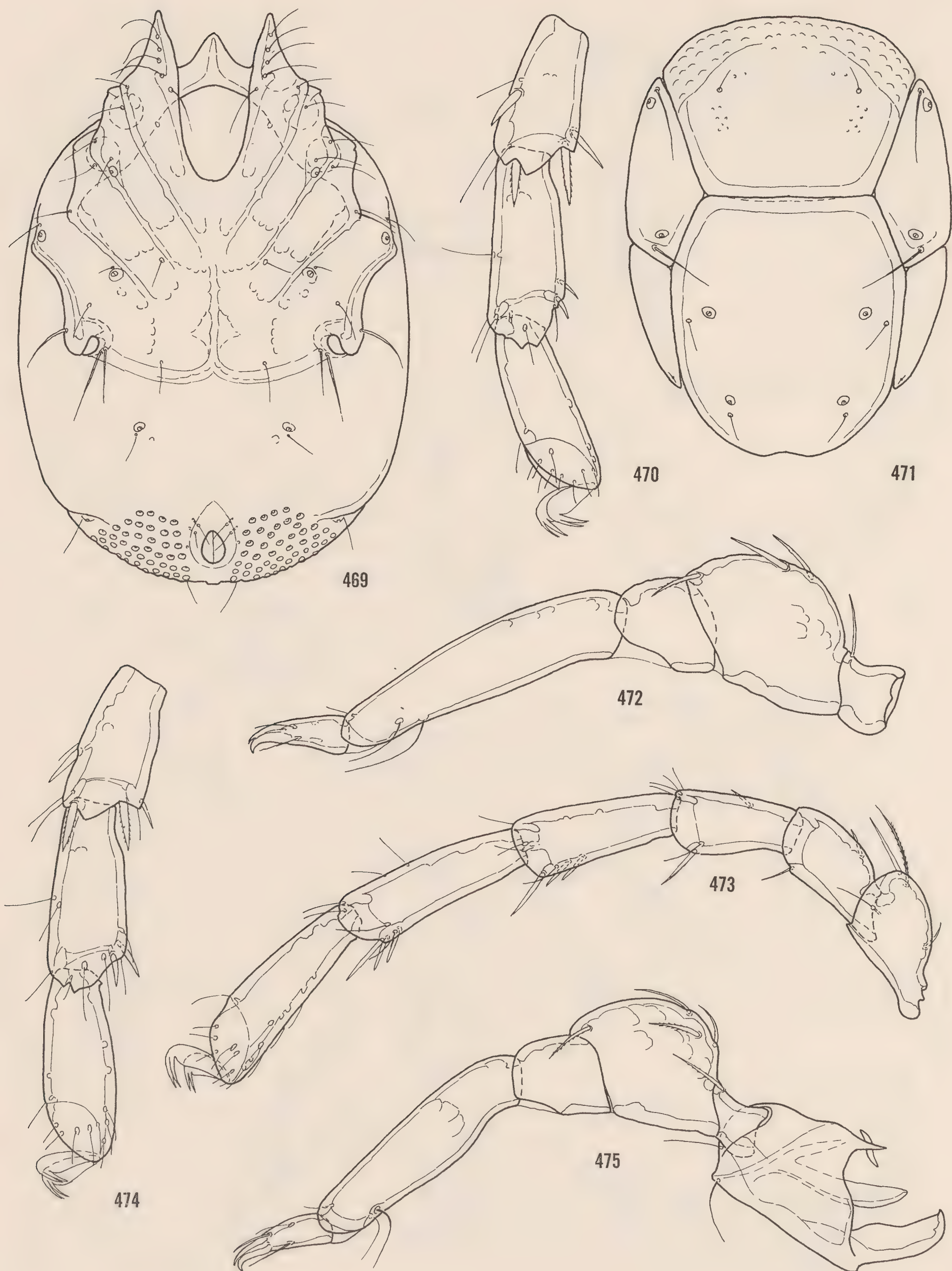


Kritaturus sornus n. sp. (Male) Fig. 456, posteroventral view of genital field; Fig. 457, ventral shield; Fig. 458, dorsal shield; Fig. 459, fourth leg; Fig. 460, distal segments of first leg; Fig. 461, palp.
Kritaturus ianthus n. sp. Fig. 462, palp, ♀.



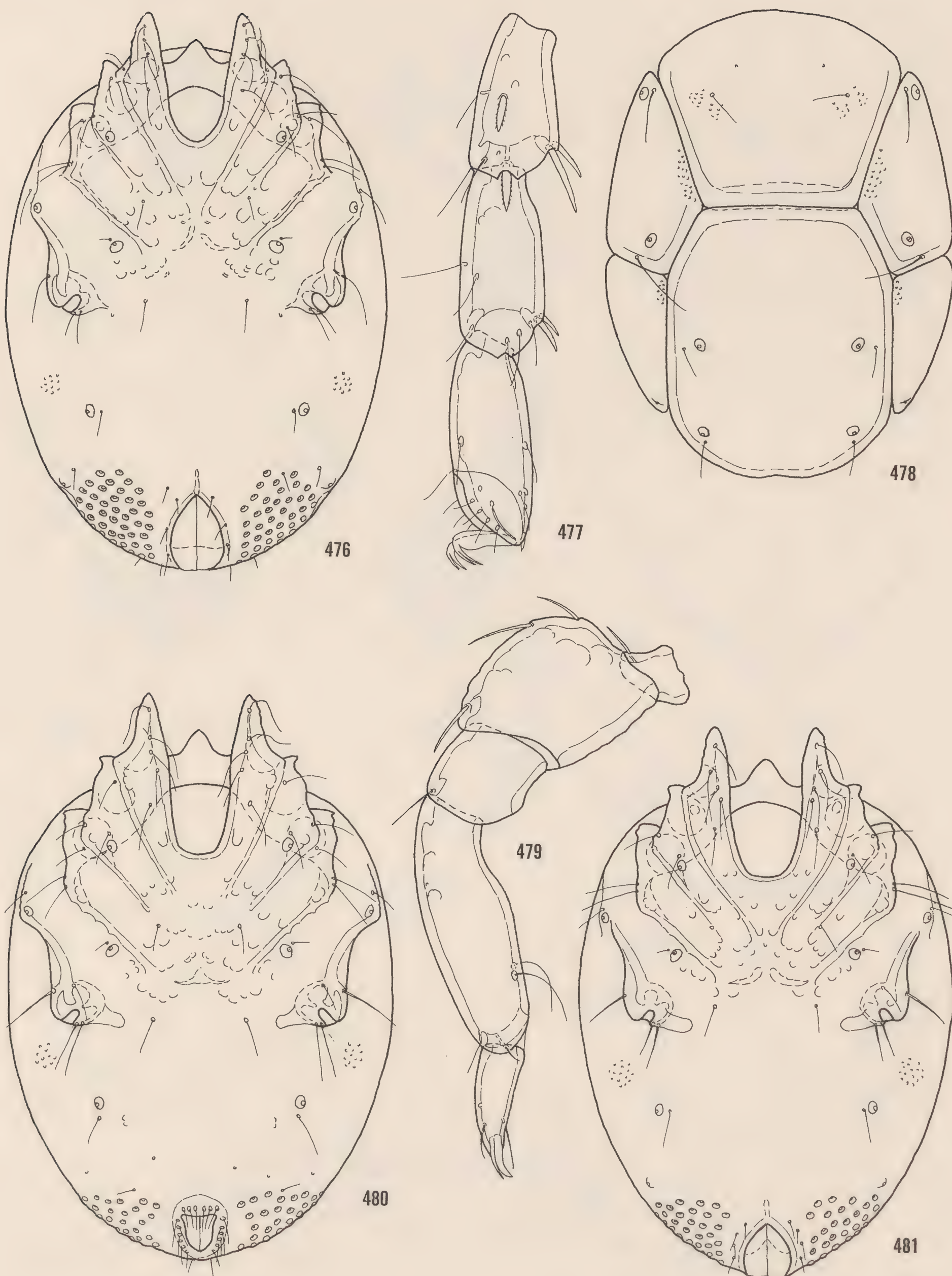
Kritaturus ianthus n. sp. (Female) Fig. 463, ventral shield; Fig. 464, distal segments of first leg; Fig. 465, dorsal shield.

Kritaturus gennadus n. sp. Fig. 466, fourth leg, ♂; Fig. 467, ventral shield, ♀; Fig. 468, dorsal shield, ♀.



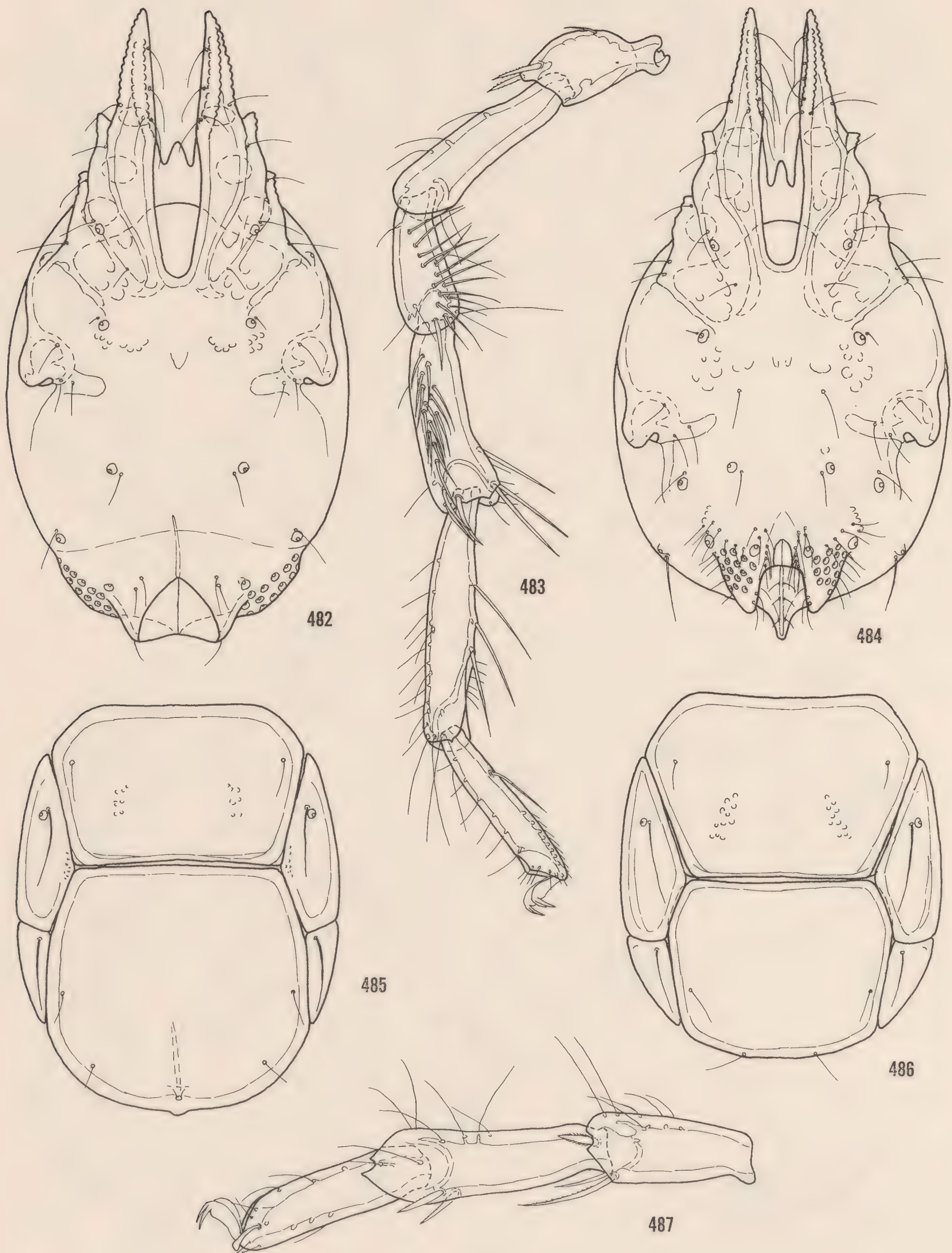
Kritaturus gennadus n. sp. Fig. 469, ventral shield, ♂; Fig. 470, distal segments of first leg, ♀; Fig. 471, dorsal shield, ♂; Fig. 472, palp, ♀.

Kritaturus dornarus n. sp. Fig. 473, fourth leg, ♂; Fig. 474, distal segments of first leg, ♀; Fig. 475, lateral view of capitulum, chelicera and palp, ♀.

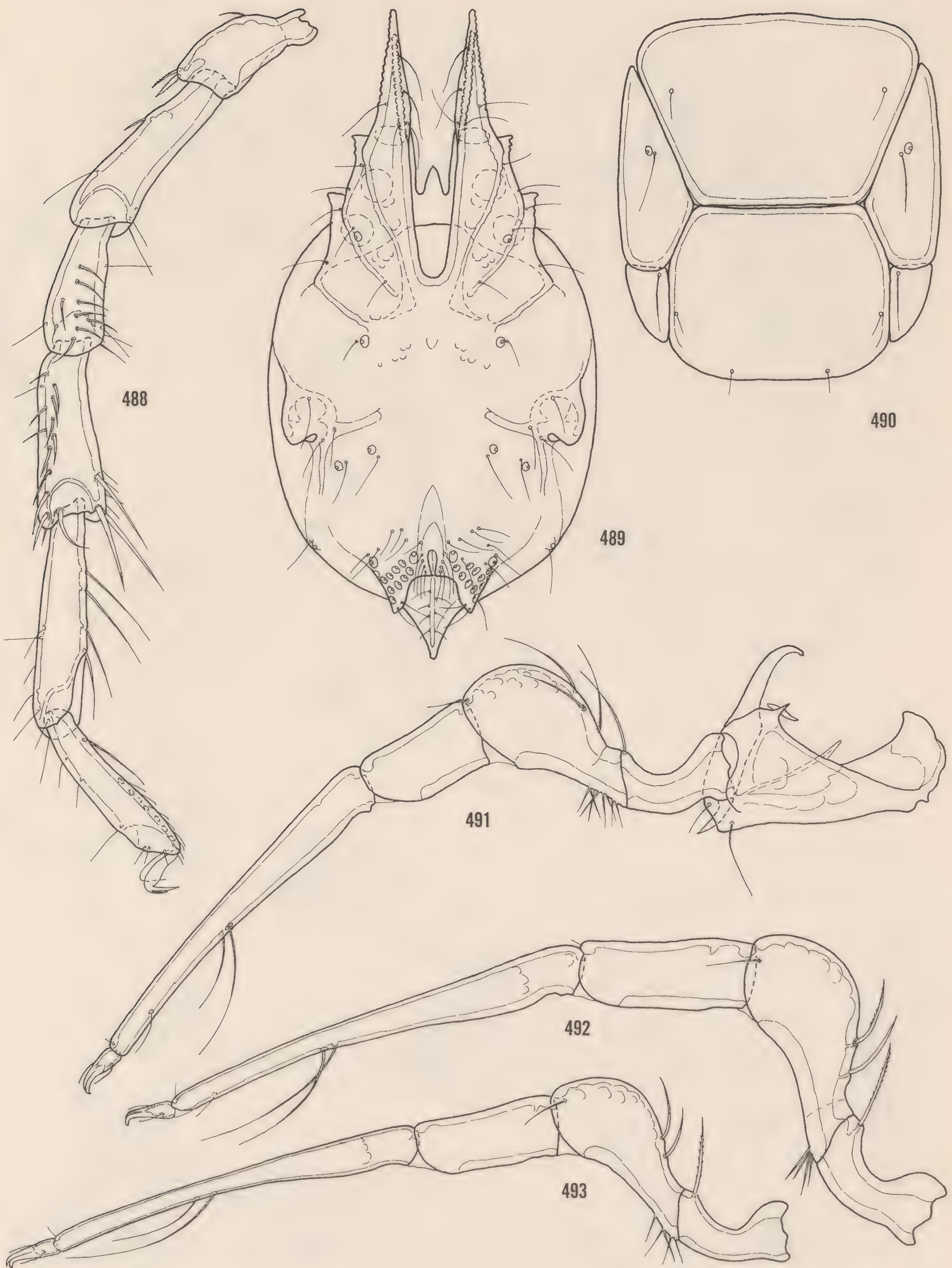


Kritaturus vinnulus n. sp. (Female) Fig. 476, ventral shield; Fig. 477, distal segments of first leg; Fig. 478, dorsal shield; Fig. 479, palp.

Kritaturus dornarus n. sp. Fig. 480, ventral shield, ♂; Fig. 481, ventral shield, ♀.



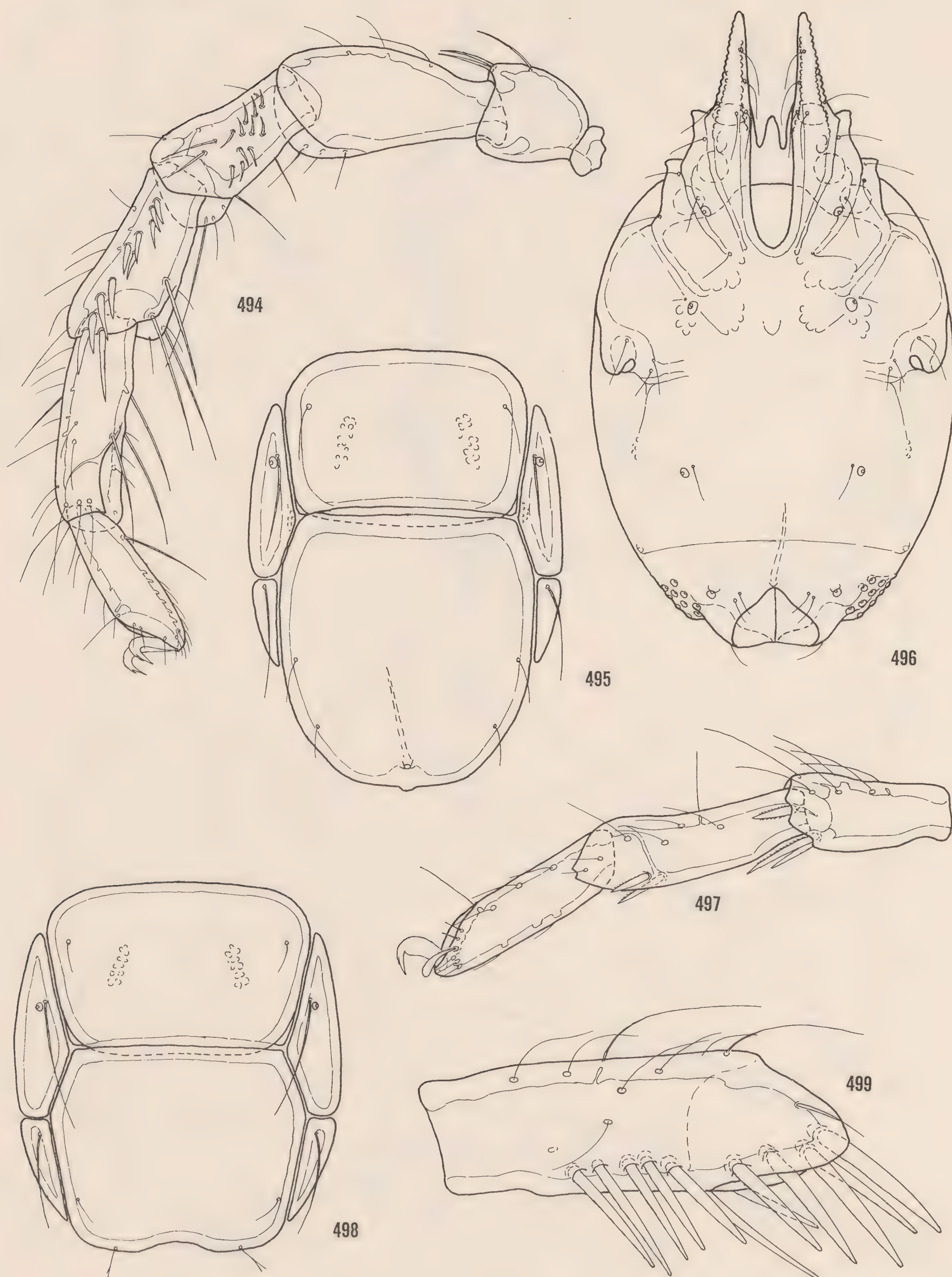
Uralbia gracilipes n. sp. Fig. 482, ventral shield, ♀; Fig. 483, fourth leg, ♂; Fig. 484, ventral shield, ♂; Fig. 485, dorsal shield, ♀; Fig. 486, dorsal shield, ♂; Fig. 487, distal segments of first leg, ♀.



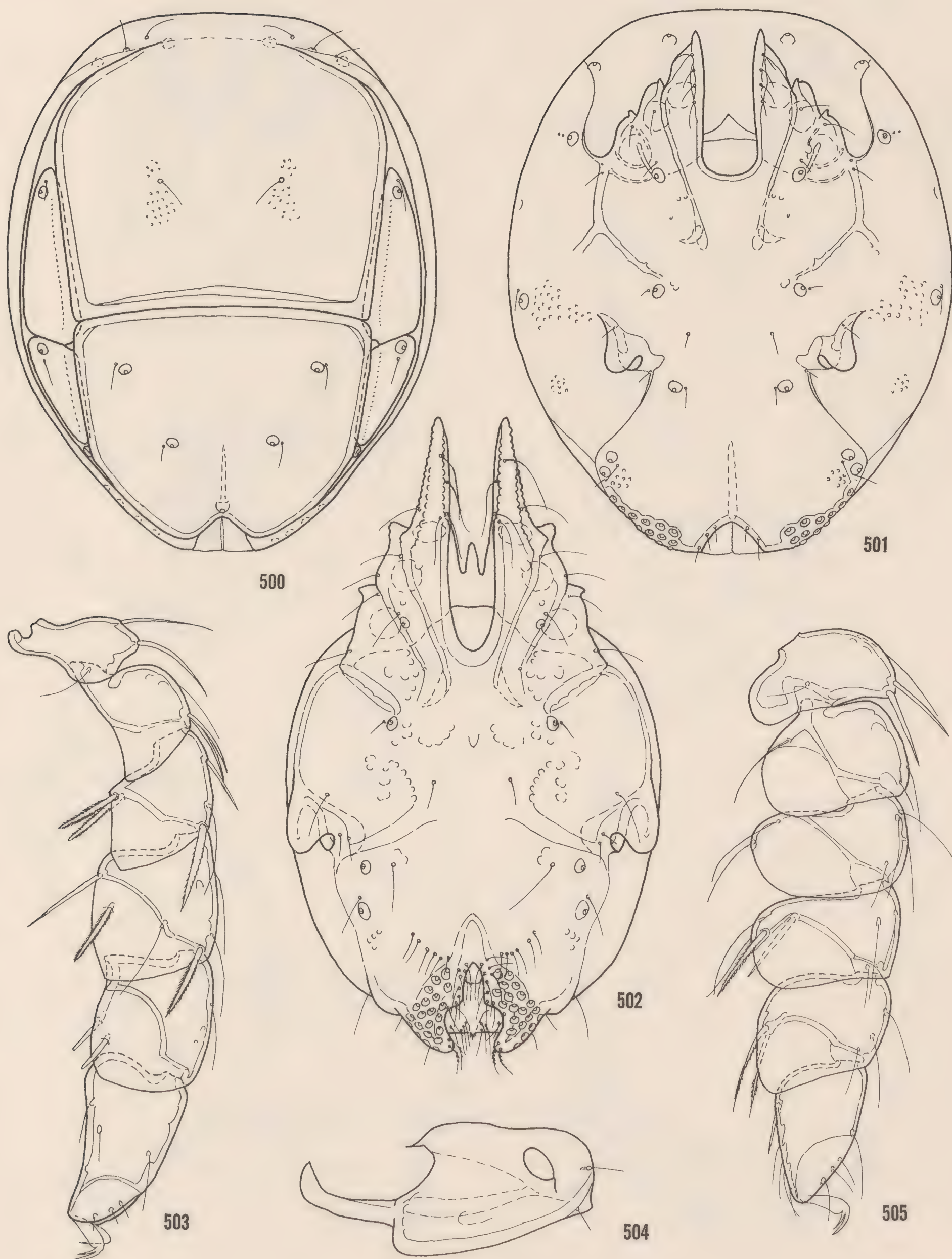
Uralbia parva n. sp. (Male) Fig. 488, fourth leg; Fig. 489, ventral shield;
Fig. 490, dorsal shield; Fig. 493, palp.

Uralbia projecta Hopkins Fig. 491, lateral view of capitulum, chelicera and
palp, ♀.

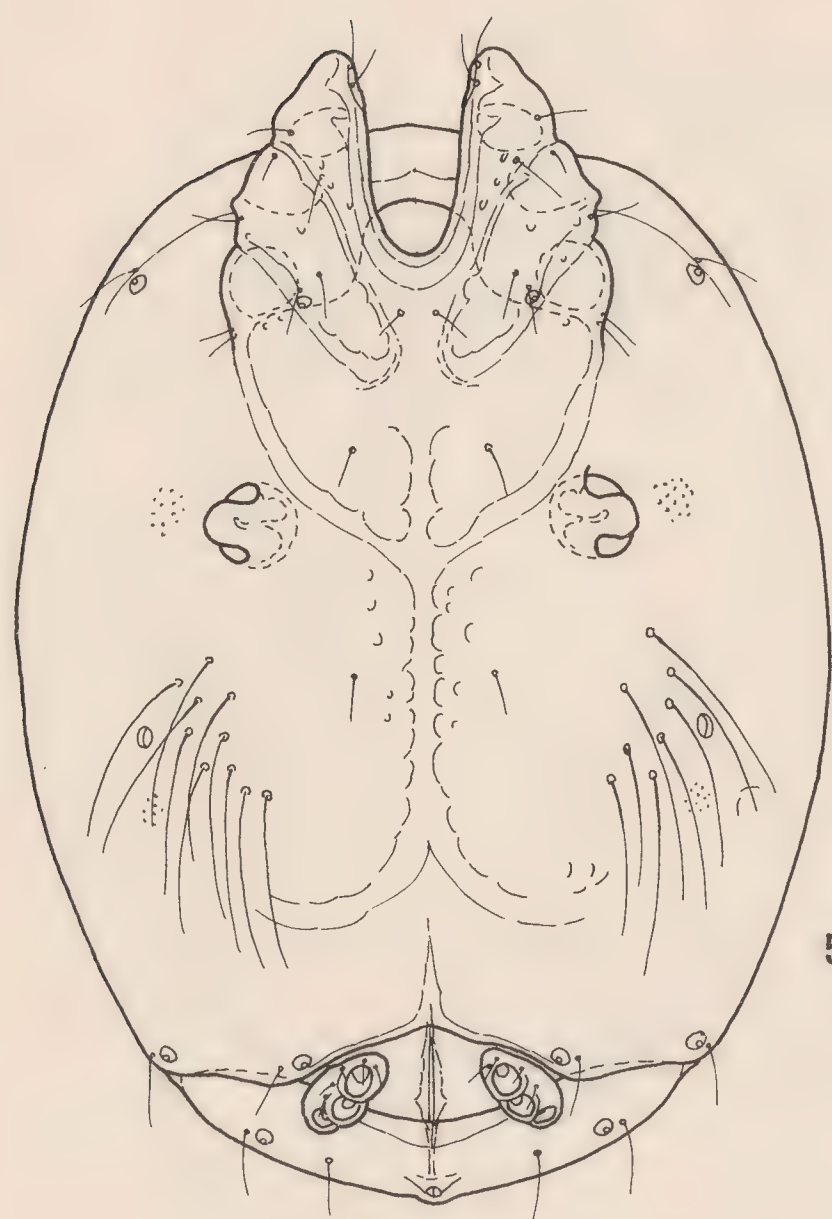
Uralbia gracilipes n. sp. Fig. 492, palp, ♀.



Uralbia projecta Hopkins Fig. 494, fourth leg, ♂; Fig. 495, dorsal shield, ♀; Fig. 496, ventral shield, ♀; Fig. 497, distal segments of first leg, ♀; Fig. 498, dorsal shield, ♂; Fig. 499, IV-Leg-4, ♂.



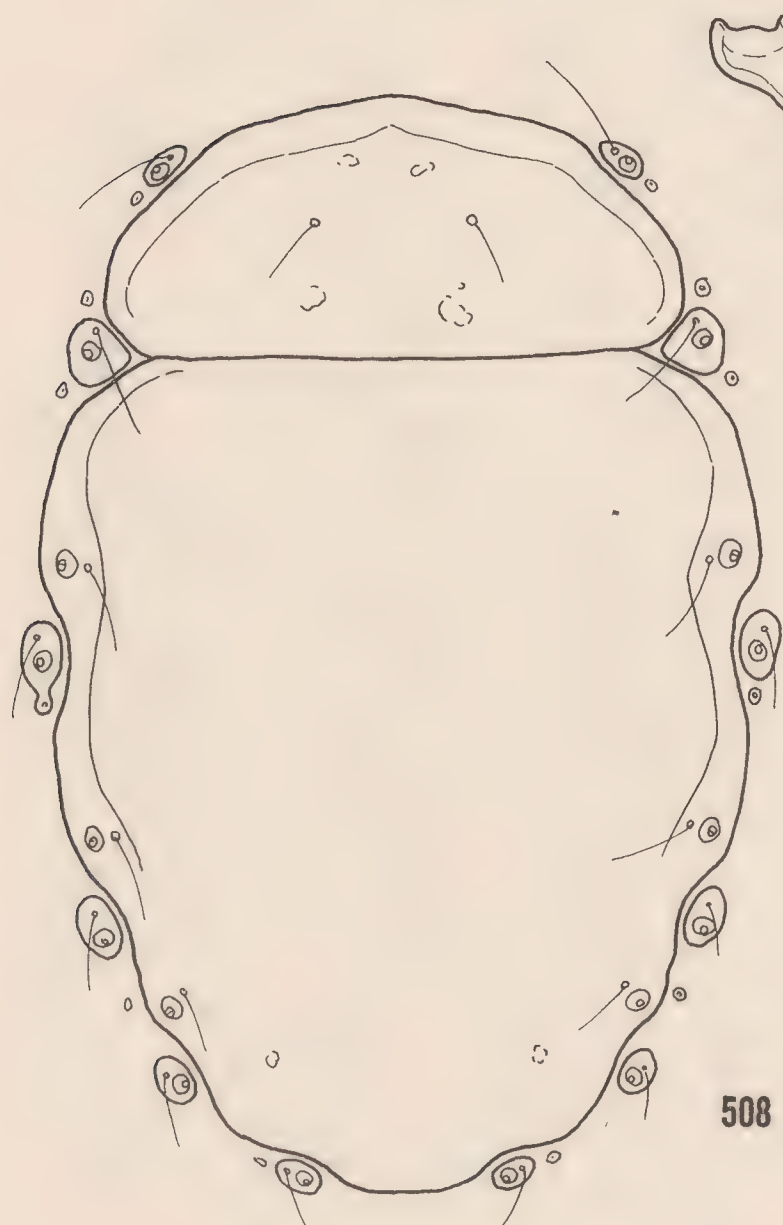
Zelandalbia imamurai n. sp. (Female) Fig. 500, dorsal shield, Fig. 501, ventral shield; Fig. 503, first leg; Fig. 504, capitulum; Fig. 505, fourth leg. Uralbia projecta Hopkins Fig. 502, ventral shield, ♂.



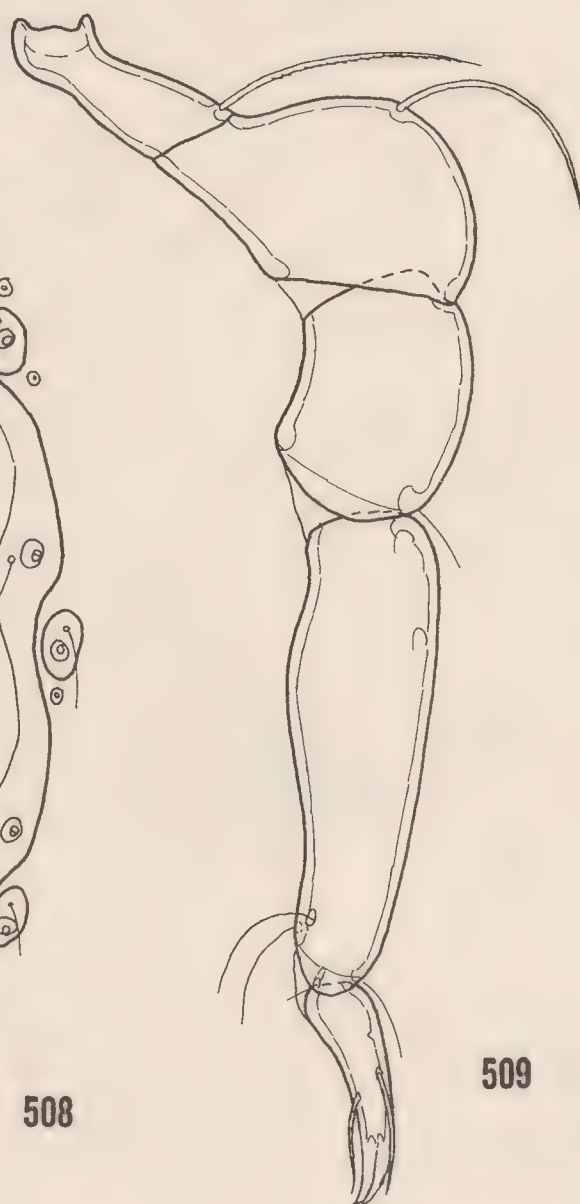
506



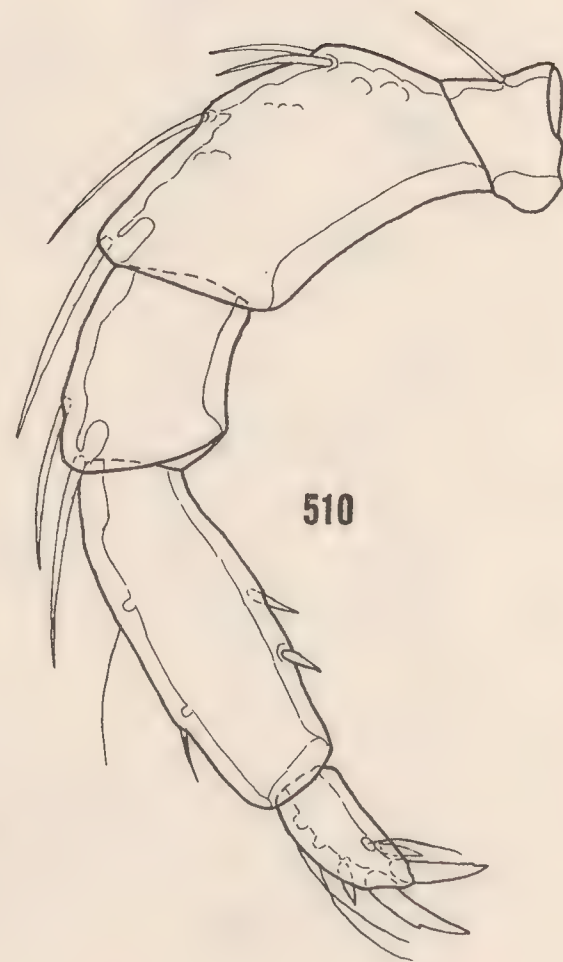
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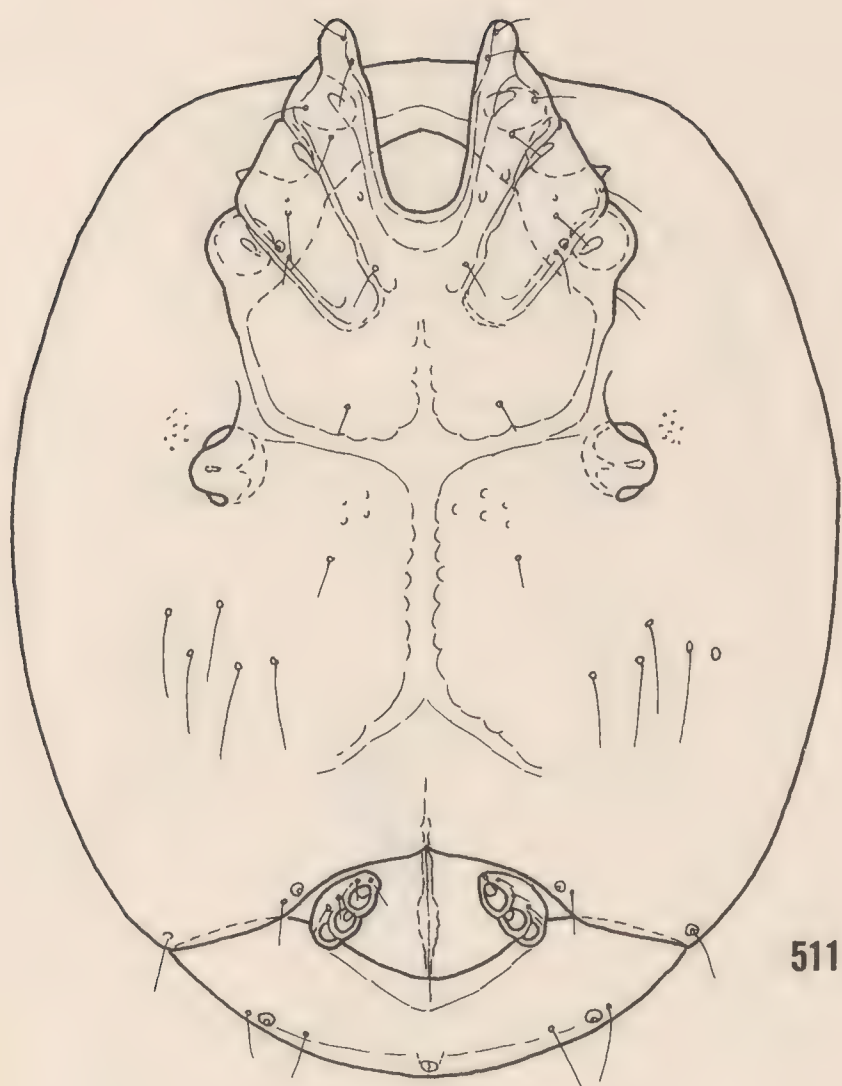


509

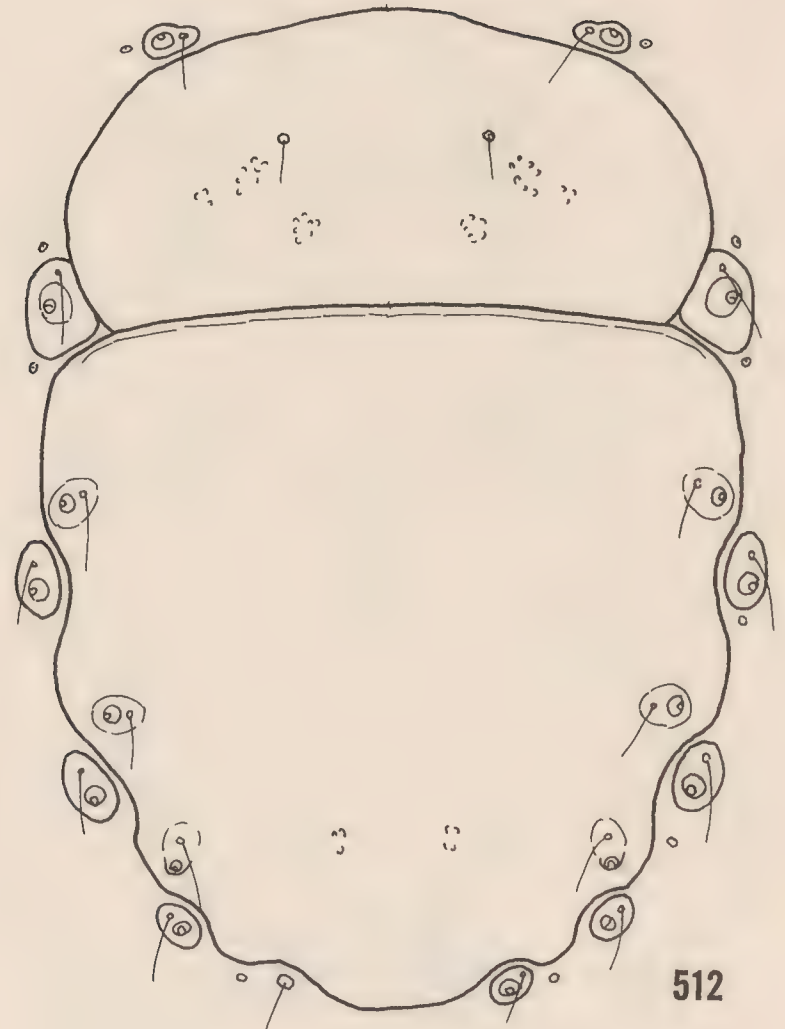


510

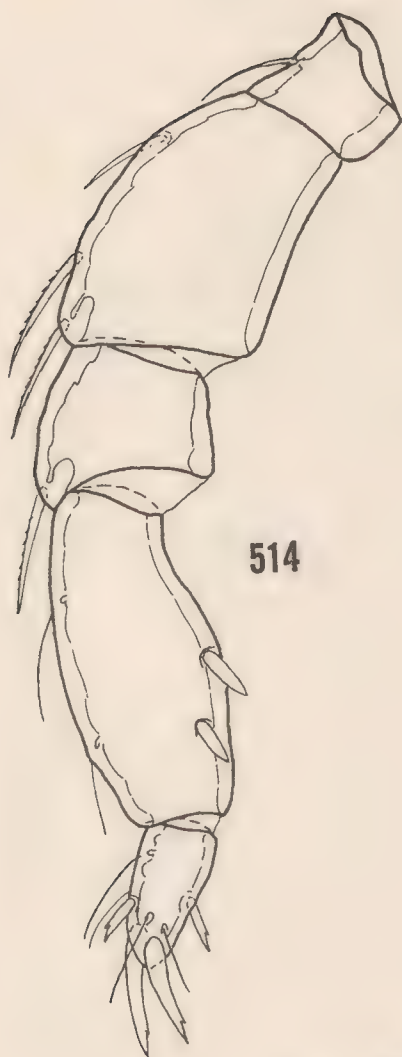
Neomomonía torquipes (Hopkins) Fig. 506, ventral shield, ♀; Fig. 507, ventral shield, ♂; Fig. 508, dorsal shield, ♂; Fig. 510, palp, ♀.
Zelandalbia imamurai n. sp. Fig. 509, palp, ♀.



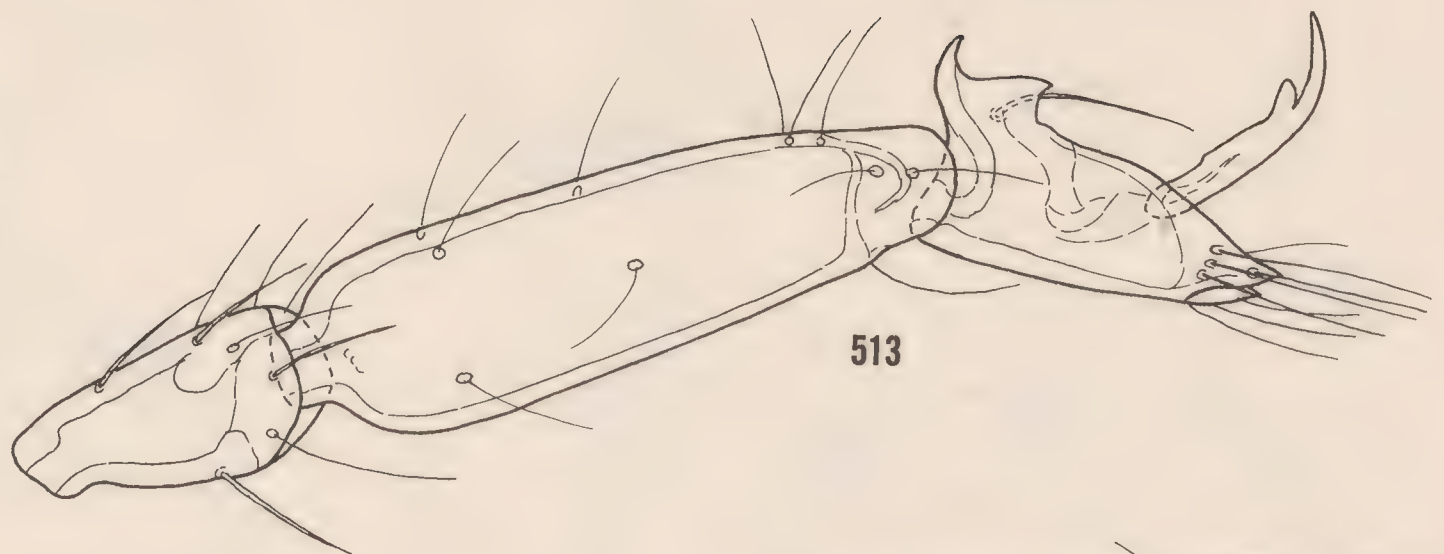
511



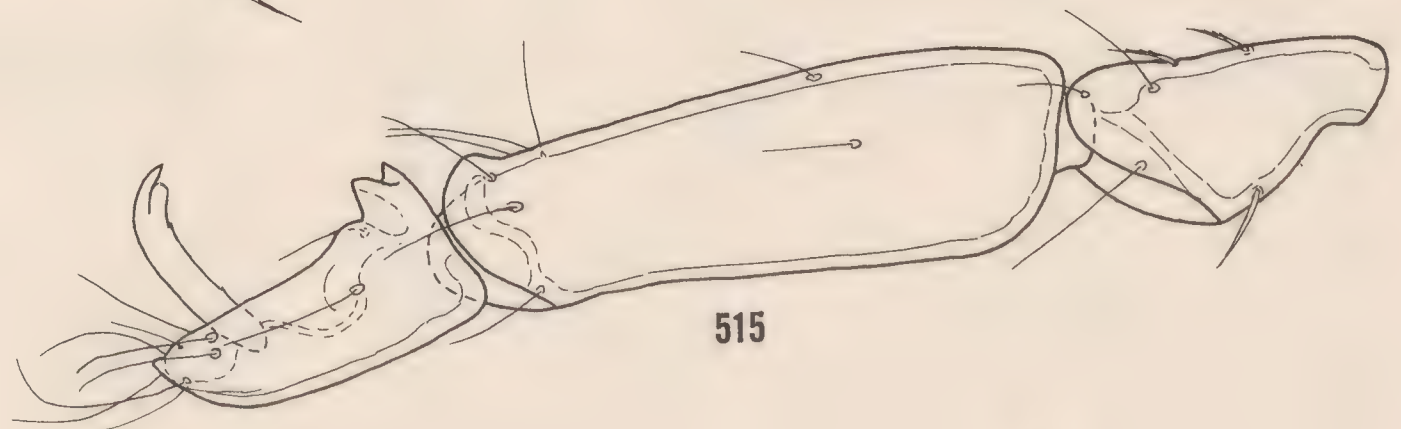
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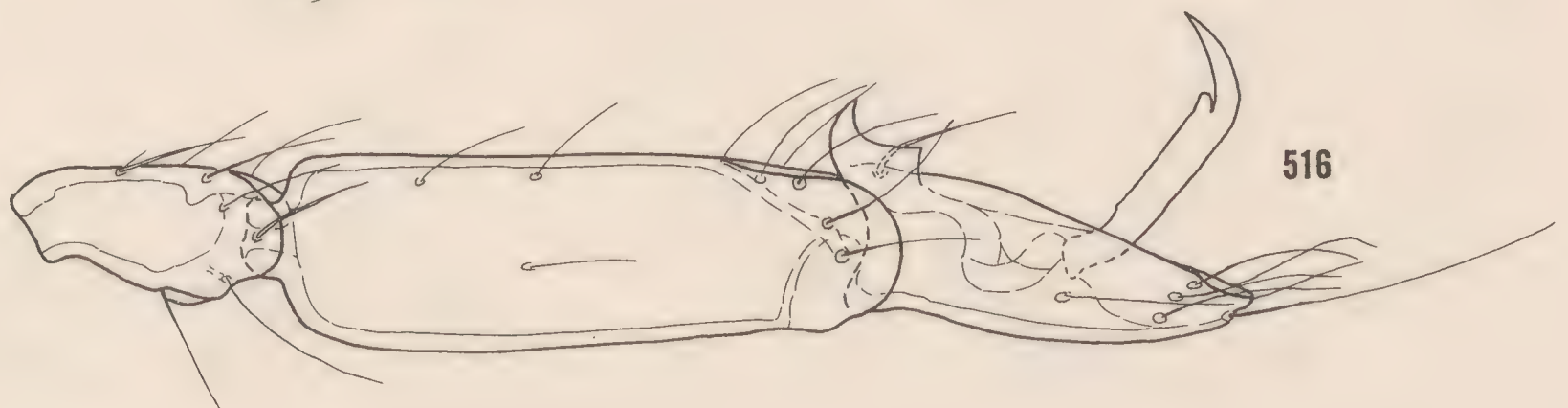
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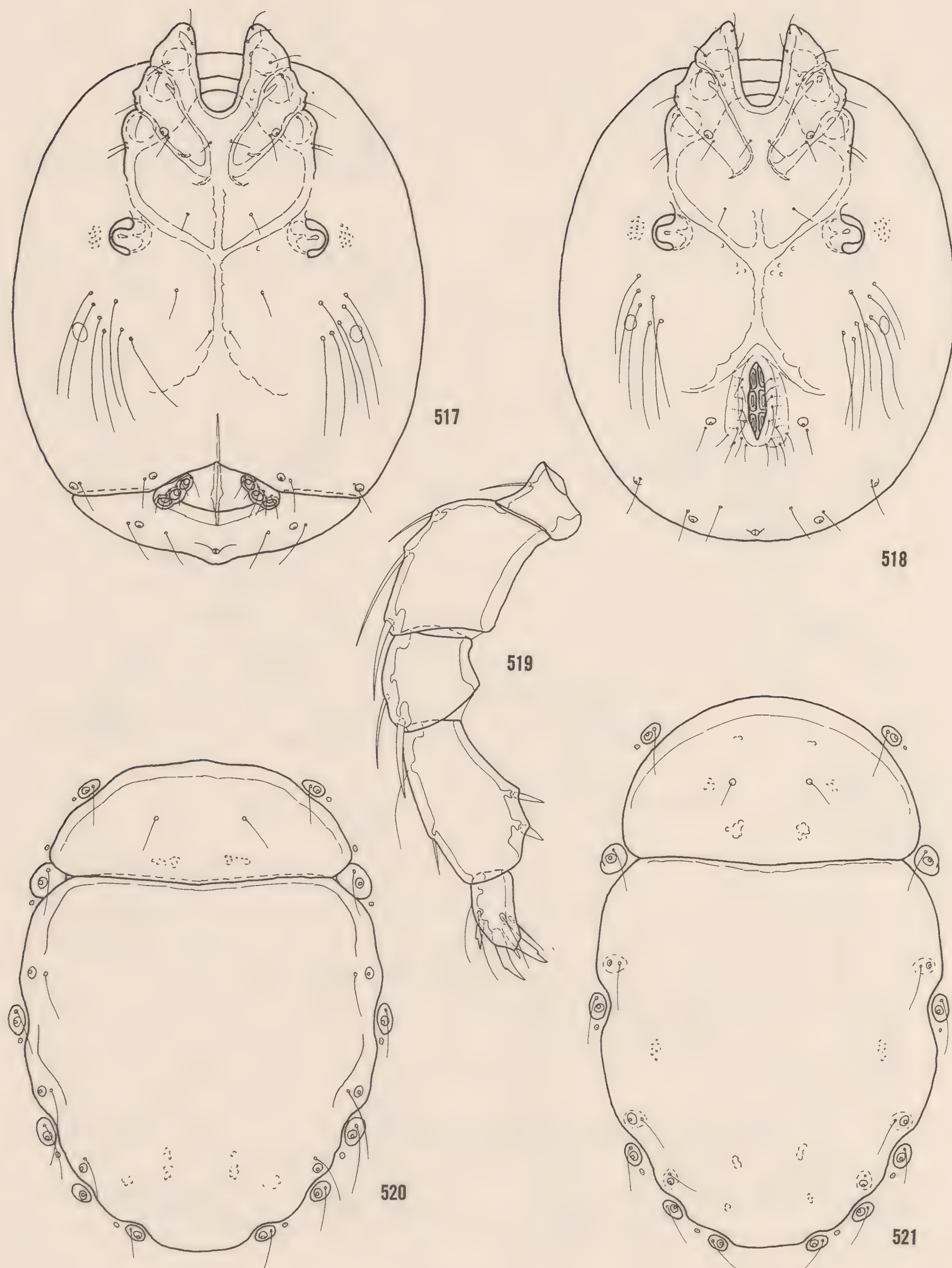


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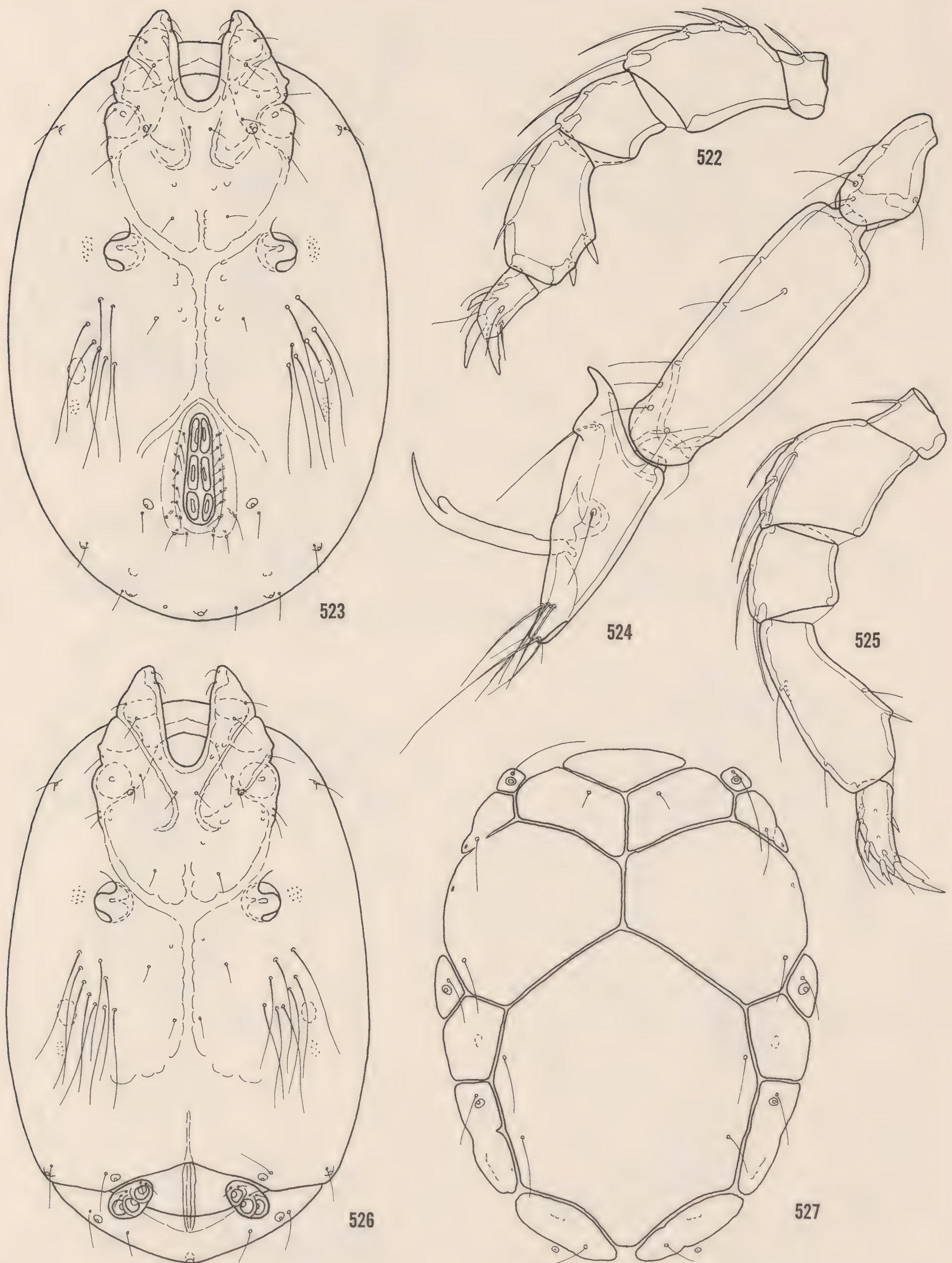


516

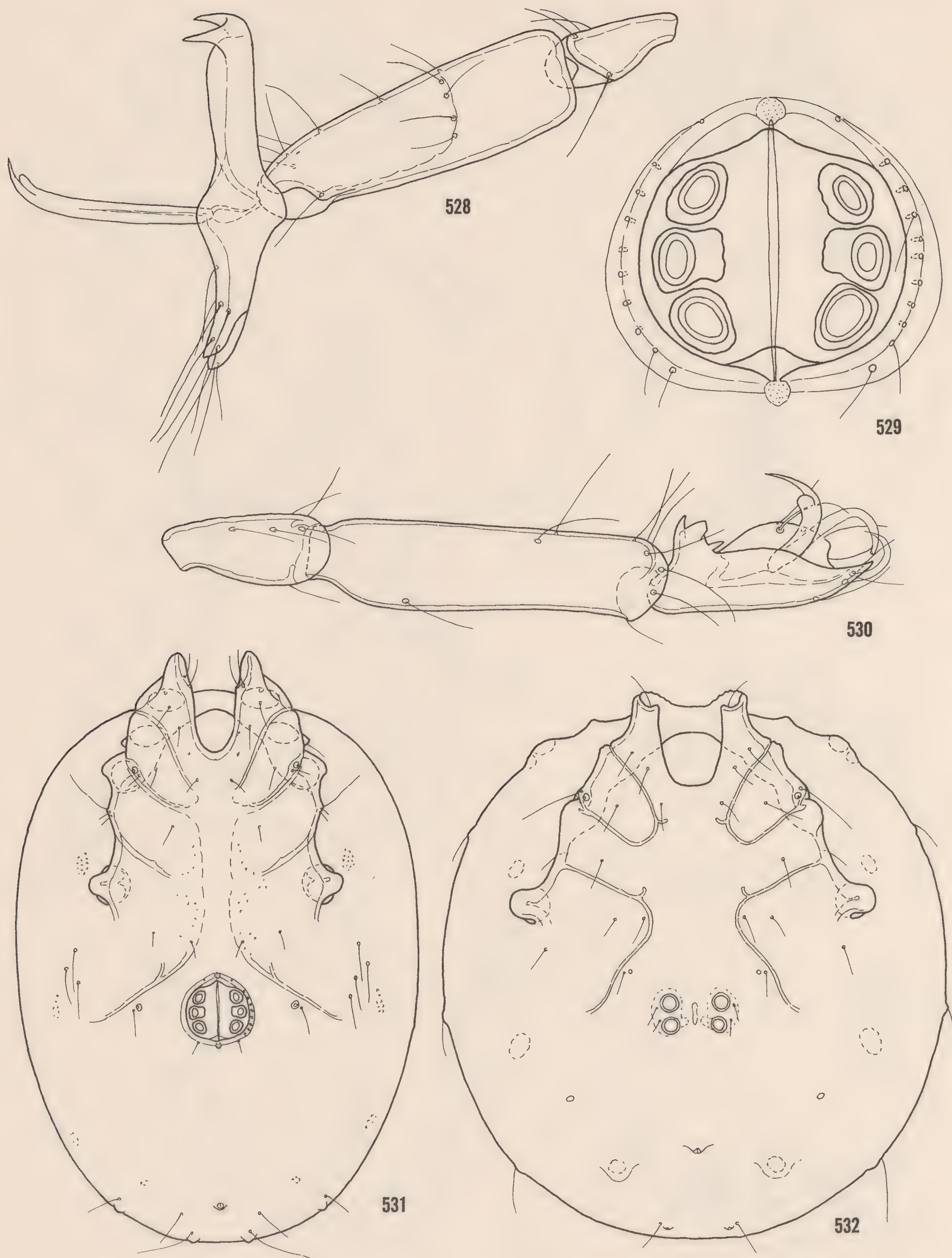
Neomomonía hopkinsi n. sp. (Female) Fig. 511, ventral shield; Fig. 512, dorsal shield; Fig. 514, palp; Fig. 515, distal segments of first leg.
Neomomonía torquipes (Hopkins) Fig. 513, distal segments of first leg, ♀.
Neomomonía benova n. sp. Fig. 516, distal segments of first leg, ♀.



Neomomonía benova n. sp. Fig. 517, ventral shield, ♀; Fig. 518, ventral shield, ♂; Fig. 519, palp, ♀; Fig. 520, dorsal shield, ♀.
Neomomonía paramecia n. sp. Fig. 521, dorsal shield, ♂.

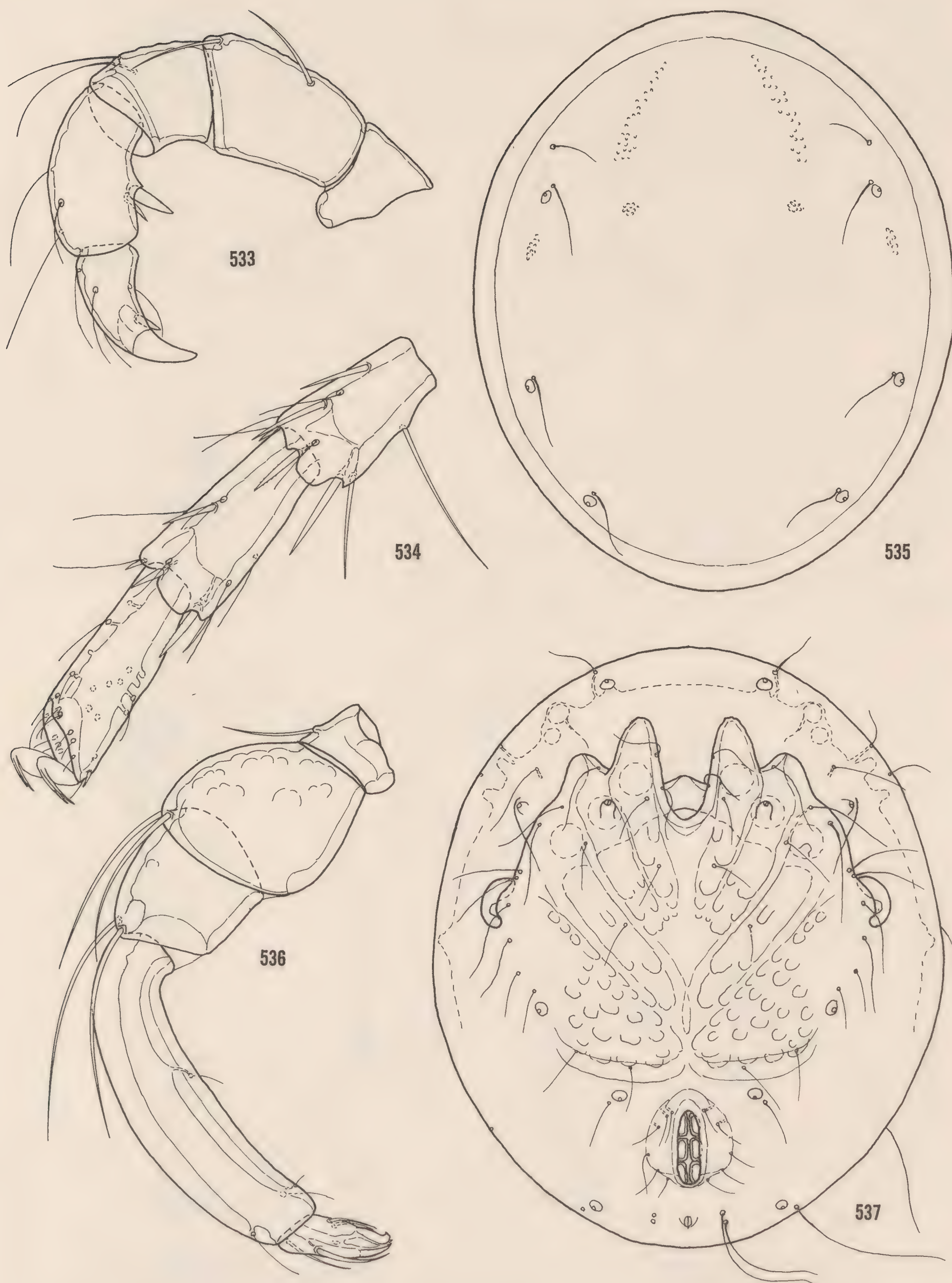


Neomomonía paramecia n. sp. Fig. 522, palp, ♂; Fig. 523, ventral shield, ♂;
 Fig. 524, distal segments of first leg, ♂; Fig. 526, ventral shield, ♀.
Partidomonía polyplacophora n. sp. Fig. 525, palp, ♂; Fig. 527, dorsal
 shield, ♂.



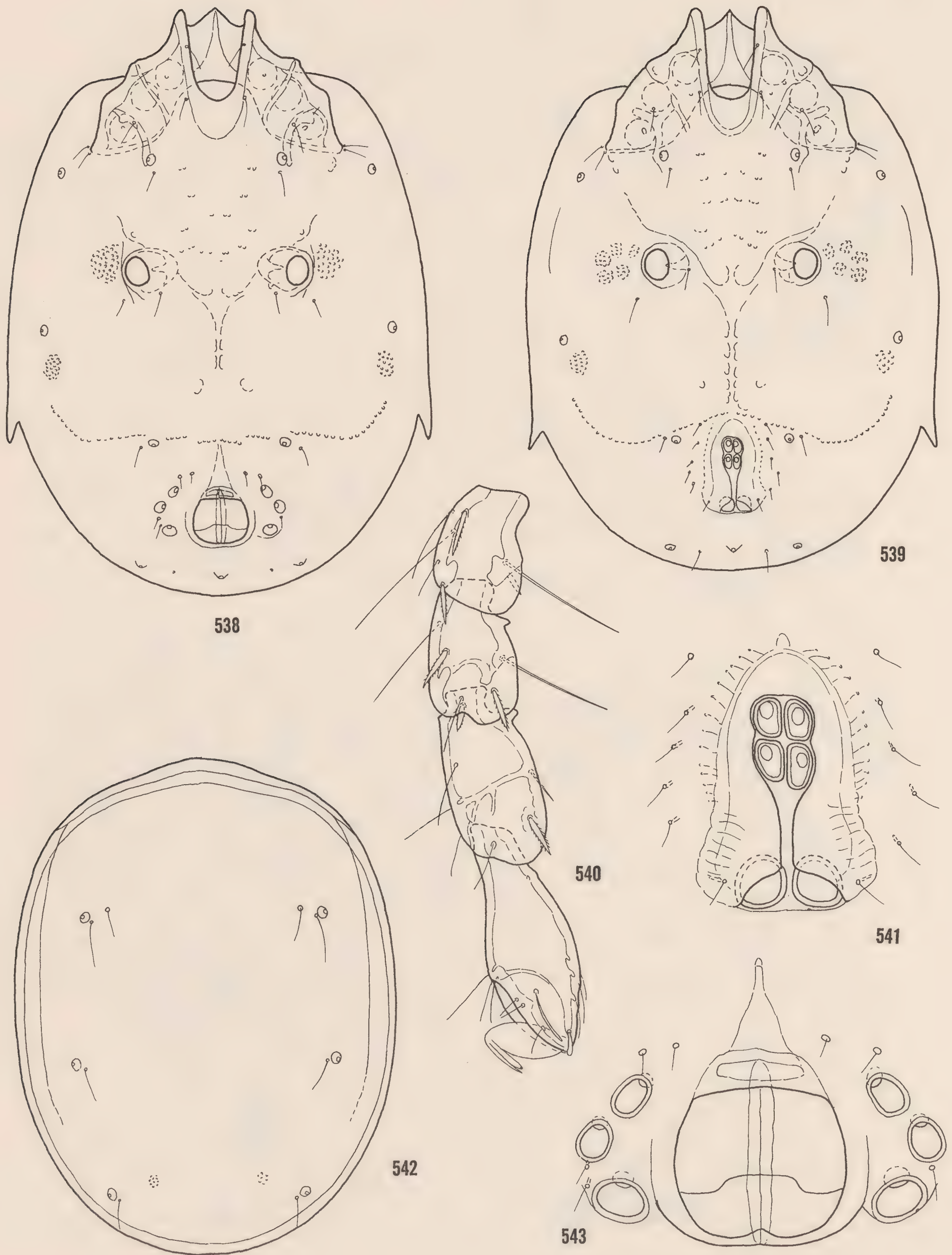
Partidomomonia polyplacophora n. sp. (Male) Fig. 528, distal segments of the first leg; Fig. 529, genital field; Fig. 531, ventral shield.

Momoniella sp. (Nymph) Fig. 530, distal segments of first leg; Fig. 532, ventral shield.

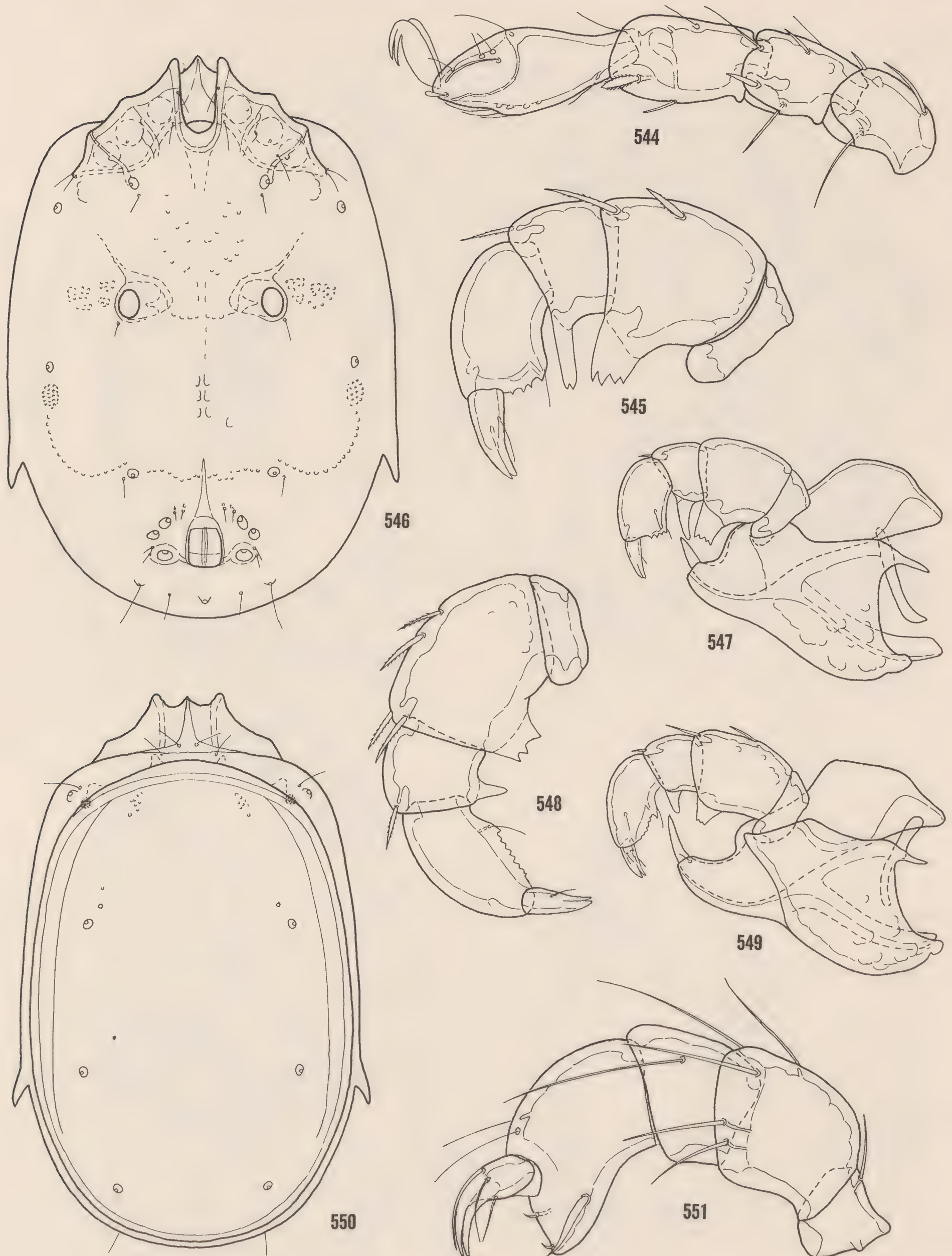


Momoniella sp. Fig. 533, palp, nymph.

Nudomideopsis forkensis (Imamura) (Male) Fig. 534, distal segments of first leg; Fig. 535, dorsal shield; Fig. 536, palp; Fig. 537, ventral shield.



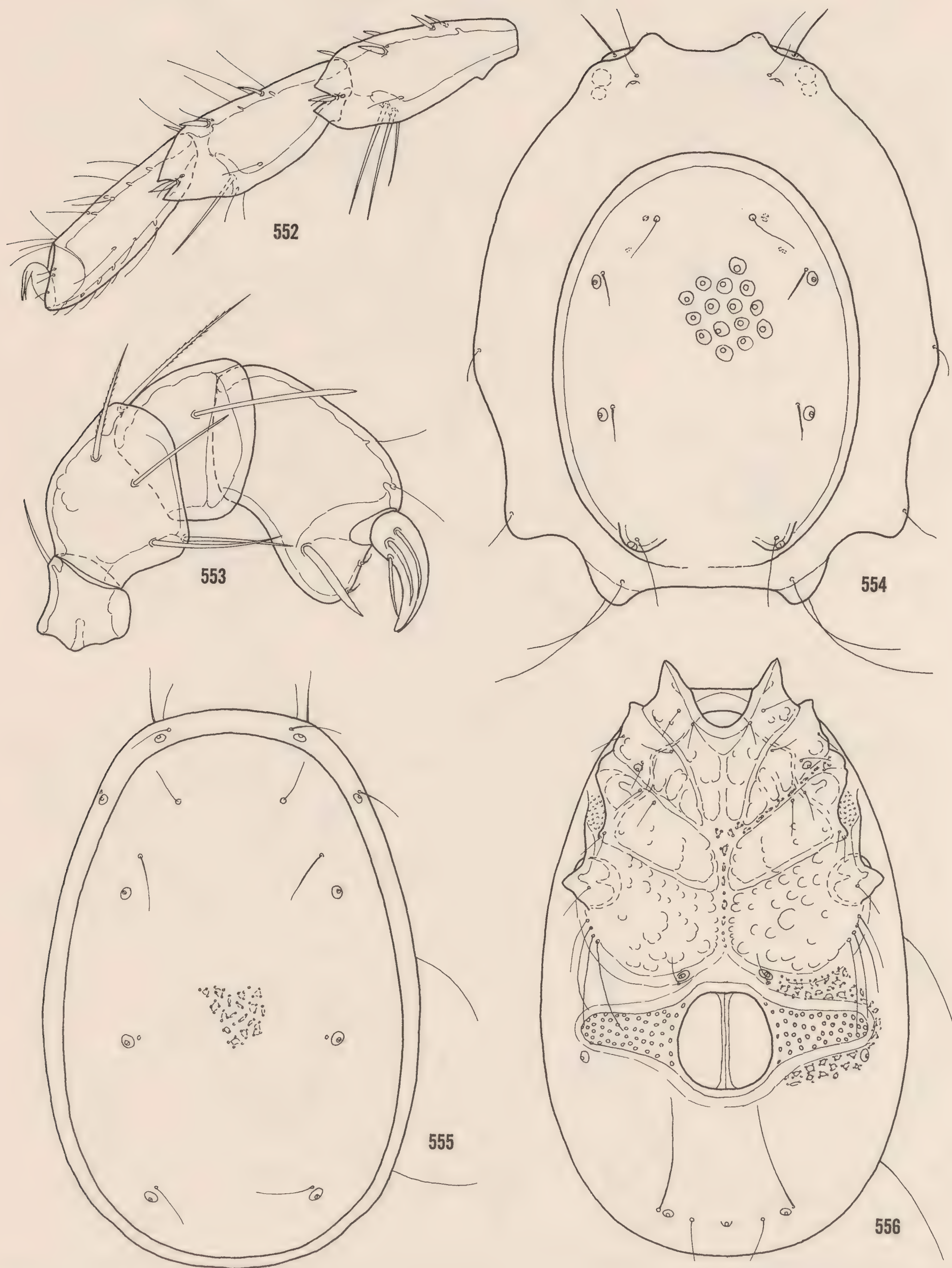
Austramideopsoides serratipalpis n. sp. Fig. 538, ventral shield, ♀; Fig. 539, ventral shield, ♂; Fig. 540, distal segments of first leg, ♀; Fig. 541, genital field area, ♂; Fig. 542, dorsal shield, ♀; Fig. 543, genital field area, ♀.



Austramideoopsoides ramsayi n. sp. (Female) Fig. 544, distal segments of first leg; Fig. 545, palp; Fig. 546, ventral shield; Fig. 547, lateral view of capitulum, chelicera and palp; Fig. 550, dorsal view.

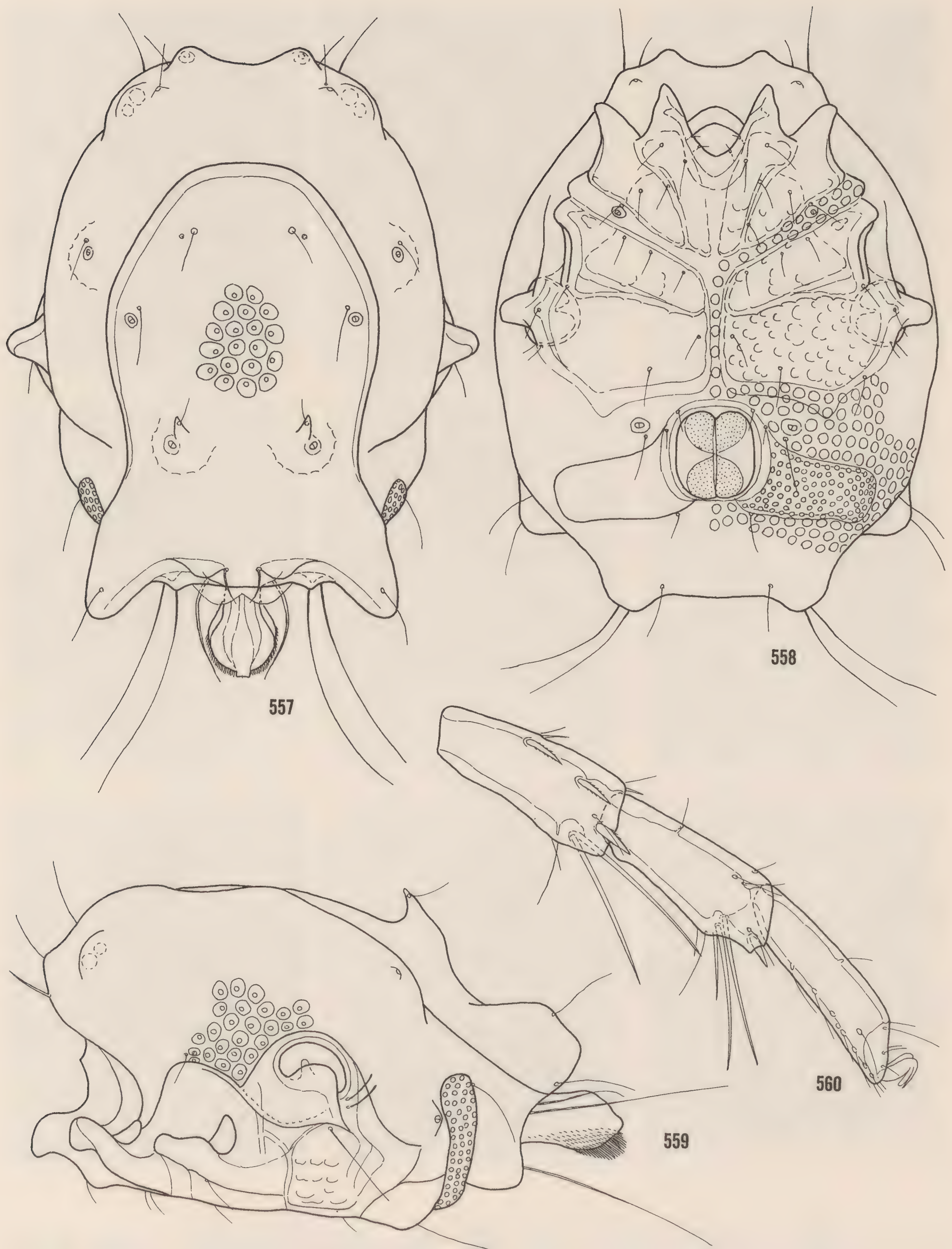
Austramideoopsoides serratipalpis n. sp. Fig. 548, palp, ♀; Fig. 549, lateral view of capitulum, chelicera and palp, ♀.

Arrenurus zelandicus n. sp. Fig. 551, palp, ♀.

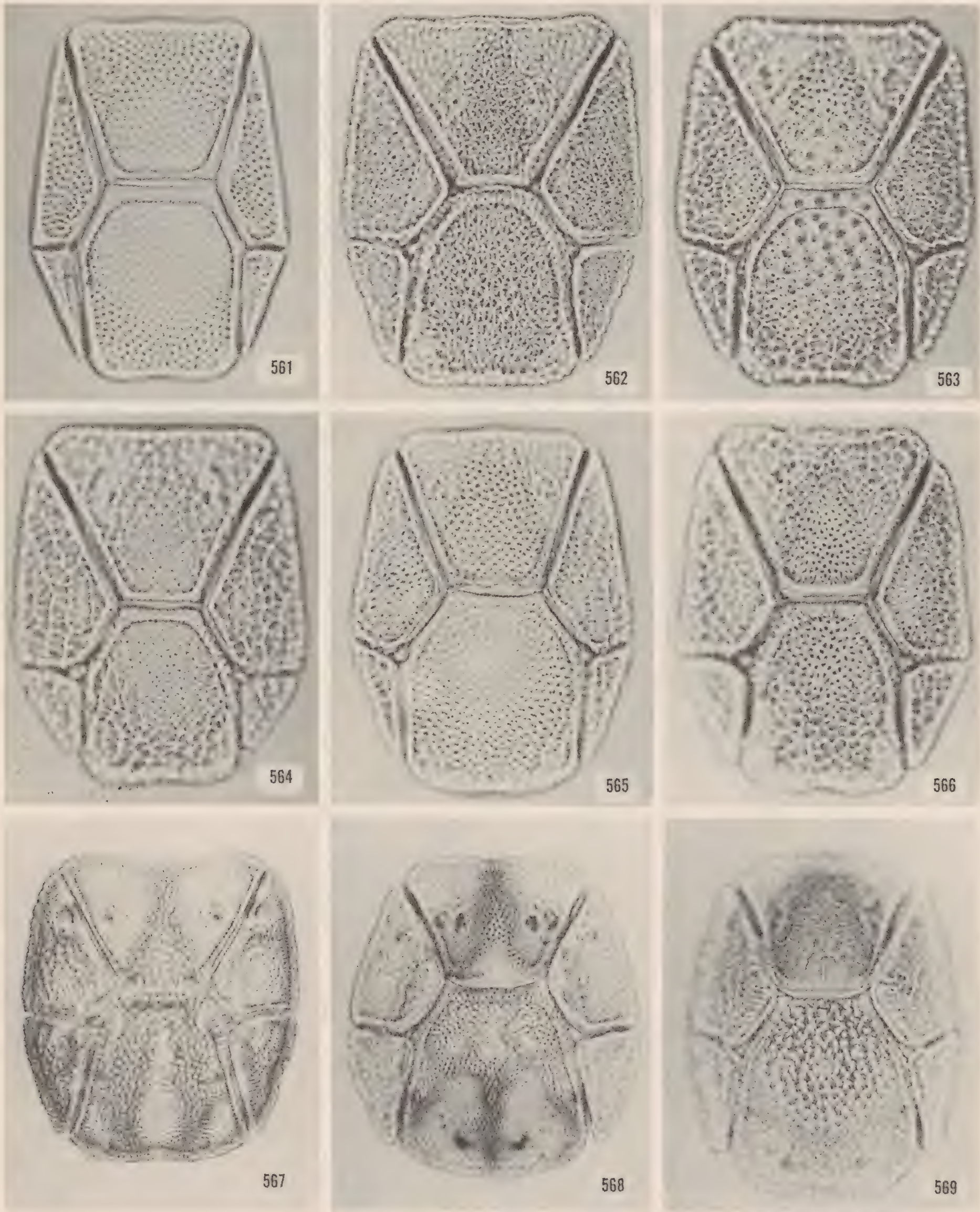


Arrenurus zelandicus n. sp. (Female) Fig. 552, distal segments of first leg; Fig. 555, dorsal view; Fig. 556, ventral shield.

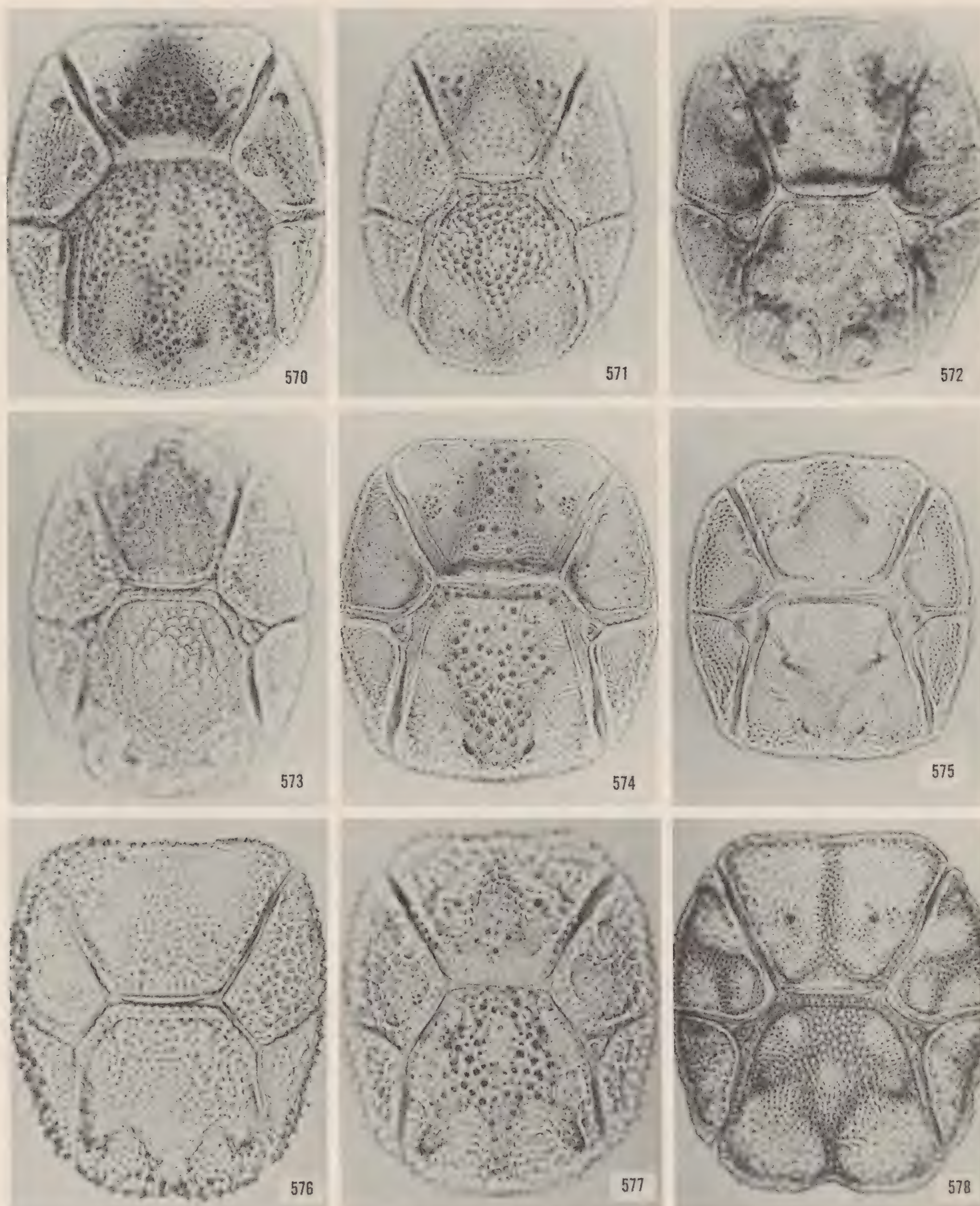
Arrenurus stouti n. sp. Fig. 553, palp, ♀; Fig. 554, dorsal view, ♀.



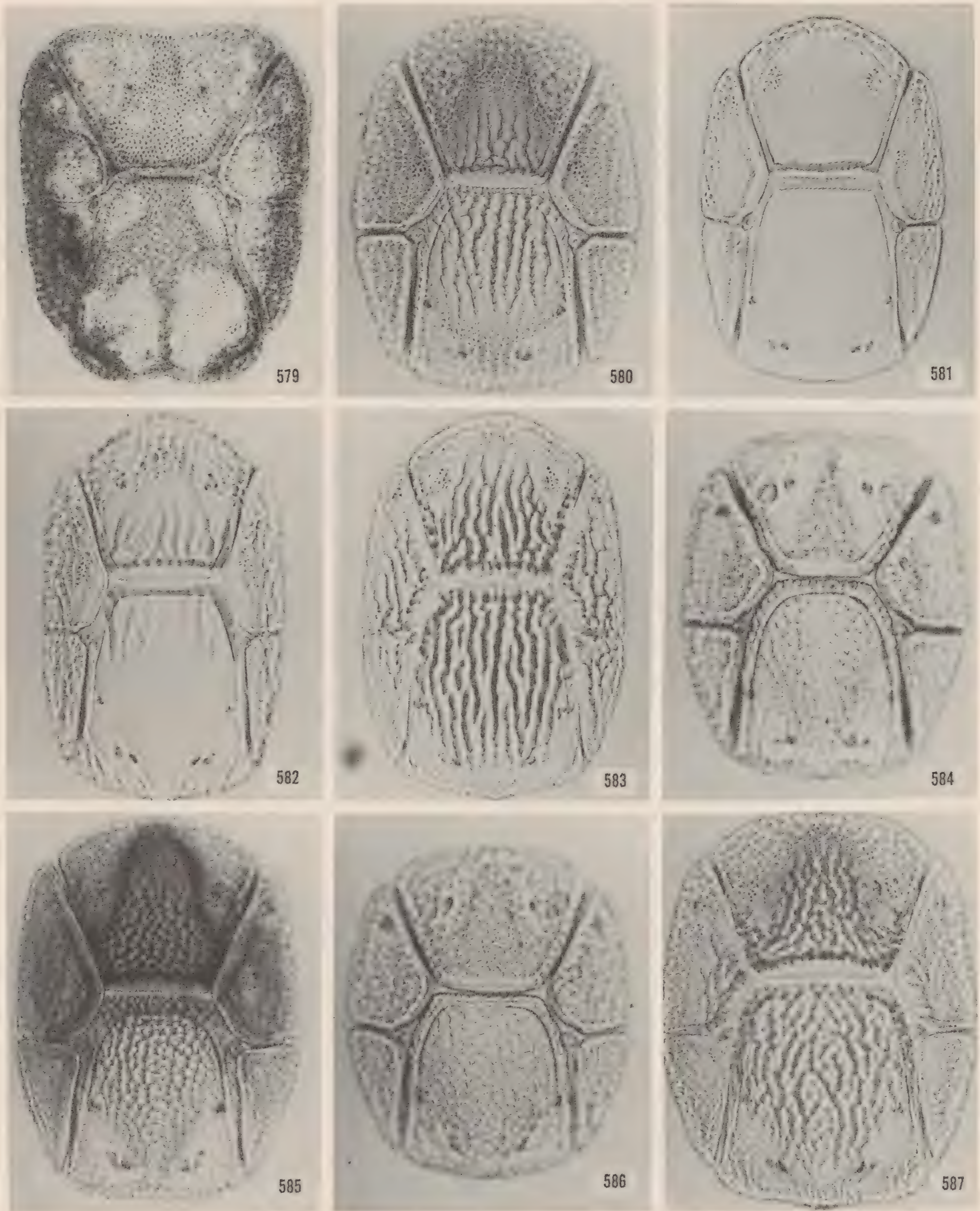
Arrenurus stouti n. sp. Fig. 557, dorsal view, ♂; Fig. 558, ventral shield, ♀; Fig. 559, lateral view, ♂; Fig. 560, distal segments of first leg, ♀.



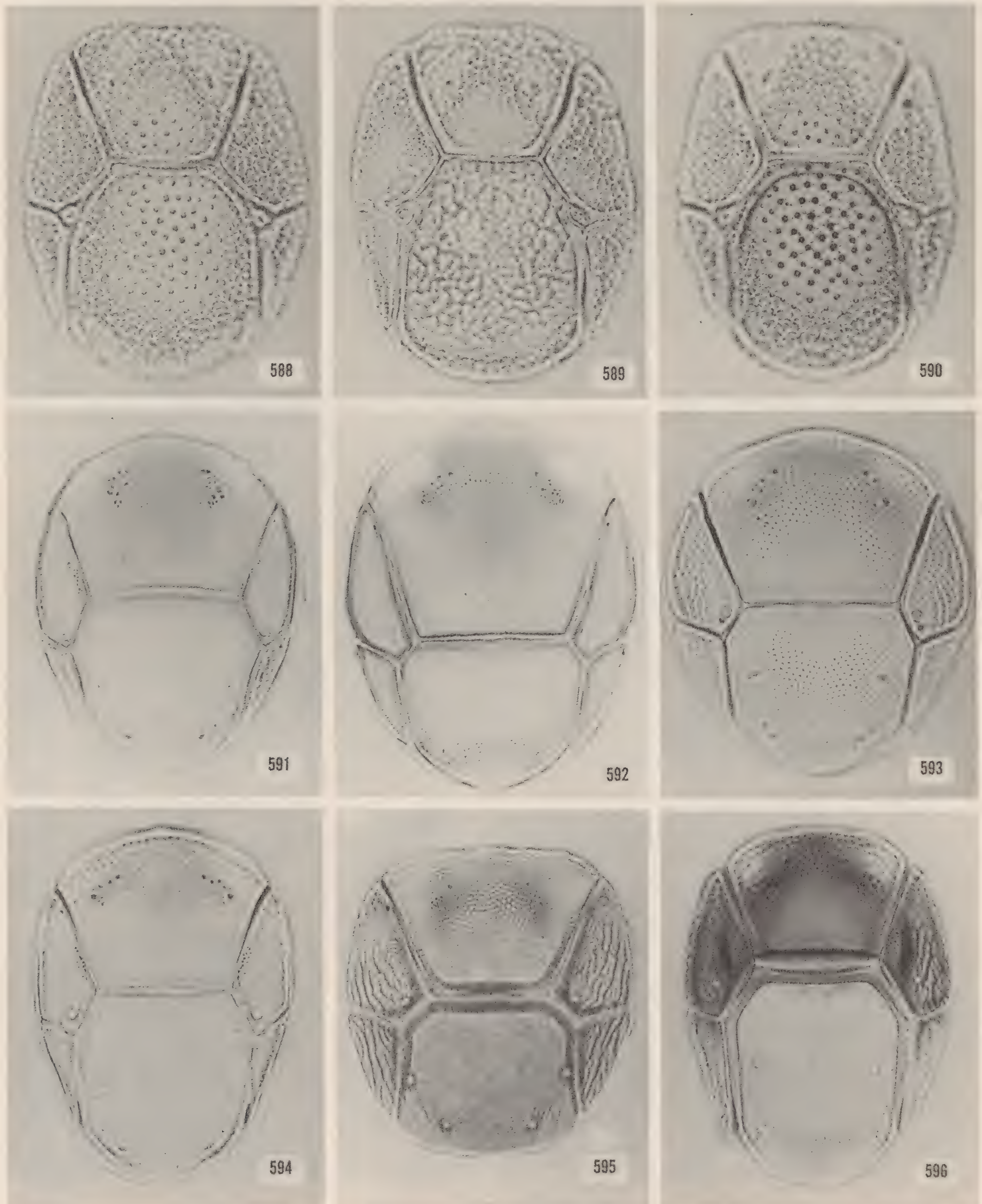
Photographs of dorsal shields. Fig. 561, Planaturus setipalpis n. sp., ♀; Fig. 562, Taintaturus hopkinsi n. sp., ♀; Fig. 563, Taintaturus abditus n. sp., ♀; Fig. 564, Taintaturus accidens n. sp., ♂; Fig. 565, Taintaturus projectus n. sp., ♀; Fig. 566, Abelaturus cornophorus n. sp., ♀; Fig. 567, Omegaturus longipalpis n. sp., ♀; Fig. 568, Tryssaturopsis asopos n. sp., ♀; Fig. 569, Tryssaturopsis novus (Hopkins), ♀.



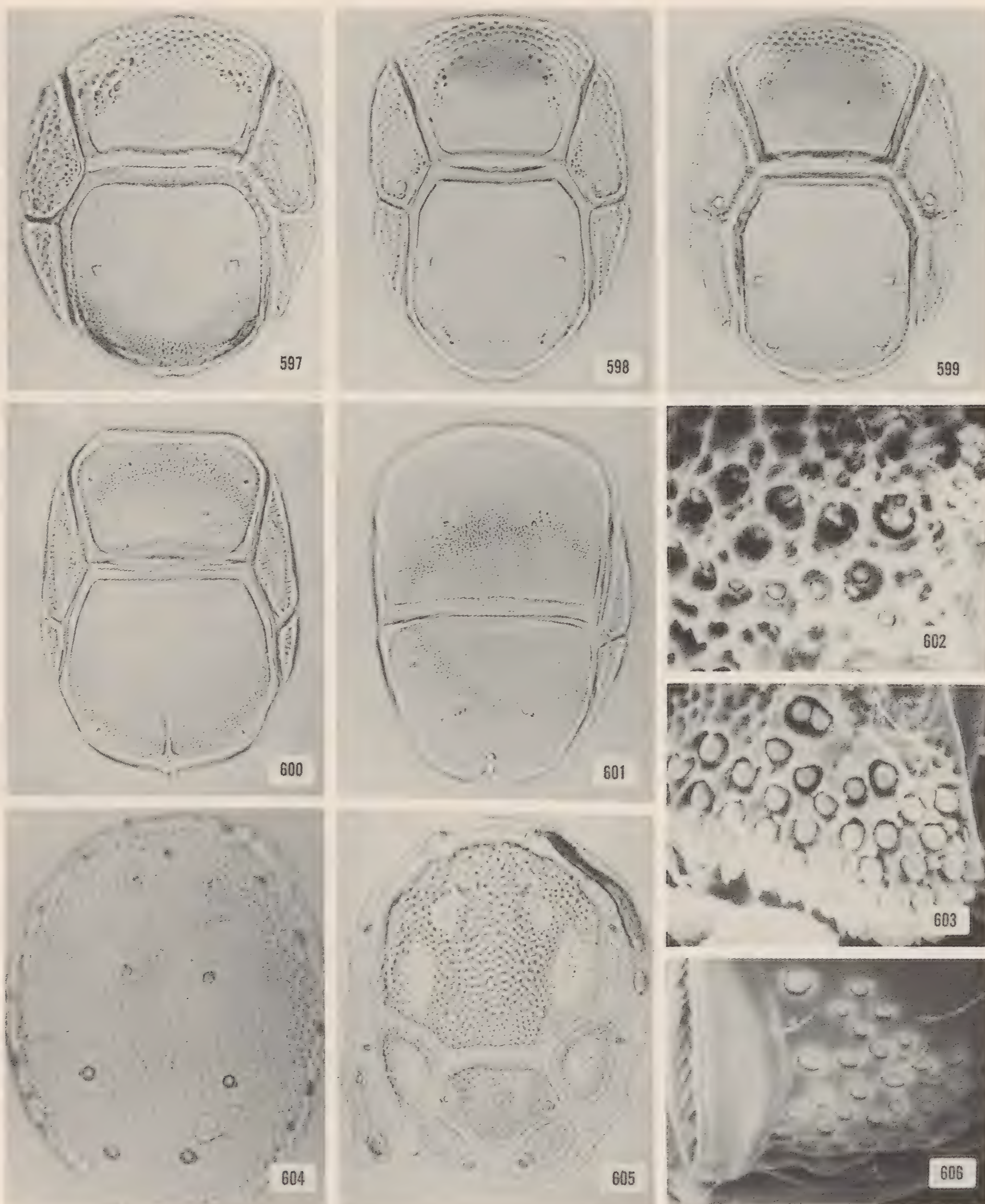
Photographs of dorsal shields. Fig. 570, Tryssaturopsis parvicaudatus n. sp., ♀; Fig. 571, Tryssaturopsis solivagus n. sp., ♂; Fig. 572, Pilosaturus villosus (Hopkins), ♀; Fig. 573, Tryssaturus spinipes Hopkins, ♀; Fig. 574, Neotryssaturus inusitatus (Hopkins), ♀; Fig. 575, Neotryssaturus pallidus n. sp., ♀; Fig. 576, Evidaturus exilis n. sp., ♀; Fig. 577, Evidaturus exilis n. sp., ♀; Fig. 578, Piotaturus alvecaudatus n. sp., ♀.



Photographs of dorsal shields. Fig. 579, Piotaturus bovalus n. sp., ♀; Fig. 580, Pseudotryssaturus indentatus (Hopkins), ♀; Fig. 581, Pseudotryssaturus planus n. sp., ♀; Fig. 582, Pseudotryssaturus anchistus n. sp., ♀; Fig. 583, Pseudotryssaturus anchistus n. sp., ♀; Fig. 584, Pseudotryssaturus papillidermis n. sp., ♀; Fig. 585, Pseudotryssaturus dapsilus n. sp., ♀; Fig. 586, Pseudotryssaturus acutus n. sp., ♀; Fig. 587, Pseudotryssaturus dictydermis n. sp., ♀.



Photographs of dorsal shields Fig. 588, Paratryssaturus minutus (Hopkins), ♀; Fig. 589, Paratryssaturus zodelus n. sp., ♂; Fig. 590, Paratryssaturus cantermus n. sp., ♀; Fig. 591, Kritaturus jacundus n. sp., ♀; Fig. 592, Kritaturus tenonus n. sp., ♀; Fig. 593, Kritaturus rucabus n. sp., ♀; Fig. 594, Kritaturus uncipalpis n. sp., ♀; Fig. 595, Kritaturus sornus n. sp., ♂; Fig. 596, Kritaturus ianthus n. sp., ♀.



Photographs of dorsal shields, unless otherwise specified. Fig. 597, Kritaturus gennadus n. sp., ♀; Fig. 598, Kritaturus dornarus n. sp., ♀; Fig. 599, Kritaturus vinnulus n. sp., ♀; Fig. 600, Uralbia gracilipes n. sp., ♀; Fig. 601, Zelandalbia imamurai n. sp., ♀; Fig. 602, Taintaturus hopkinsi n. sp., posterior view of acetabula, ♀; Fig. 603, Pseudotryssaturus indentatus (Hopkins), posterior view of acetabula, ♀; Fig. 604, Zelandobatella naias Hopkins, dorsum, ♀; Fig. 605, Zelandobates clevatus n. sp., ♂; Fig. 606, Kritaturus jacundus n. sp., posterior view of acetabula, ♀.

* An asterisk indicates a synonym.
The main reference is underscored.

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NOTES ON NEOTROPICAL TABANIDAE (DIPTERA) XX.
THE LARGER SPECIES OF TABANUS
OF EASTERN SOUTH AMERICA

by
G. B. Fairchild

NOTES ON NEOTROPICAL TABANIDAE (DIPTERA) XX.
THE LARGER SPECIES OF TABANUS
OF EASTERN SOUTH AMERICA^{1,3}

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ABSTRACT

Thirty-four large species of Tabanus are discussed, keyed and many illustrated. Distribution maps based on material seen are provided for all species. Seven new species are recognized: Tabanus aaptus n. sp. Brasil; Amazonas, Manaus; T. antunesi n. sp. Brasil; Bahia, Ilheus; T. duckei n. sp. Venezuela; Mt. Marahuaca and Colombia, Caqueta; T. humboldti n. sp. Brasil; Mato Grosso and Amazonas, Manaus; T. itaituba n. sp. Brasil; Para; T. nematocallus n. sp. Brasil; Amazonas, Manaus and Venezuela, Peru and Colombia; T. xuthopogon n. sp. Peru; Iquitos, Loreto Ecuador; Limoncocha, Brasil, Para. T. casteetus nom. nov. is proposed for T. testaceus Macq. preocc., and several new synonymies are proposed.

INTRODUCTION

This review started as an attempt to provide a key for the identification of the larger species of Tabanus known from the Amazon basin. In the course of its preparation a number of new species have turned up and certain species thought to be well known and easily recognized have turned out to be complexes of closely similar taxa. It has also proved difficult to decide which species to include and which to omit. I have tried to include all species of Tabanus averaging over 15 mm in length, with unpatterned eyes in life, without a strong scutellar black spot or a long appendix at fork of third vein, and which occur east of the main range of the Andes and north of the Argentine border. Species of the lineola group, with striped abdomens and banded eyes are being treated elsewhere. Species related to Tabanus sorbillans, with a long appendix at fork, and those with banded eyes and a more or less evident scutellar black spot, such as T. antarcticus, are omitted. Another group of mainly Andean and West coast distribution with strong central American representation, typified by Tabanus subruber, T. bigoti, T. hirtitibia etc. has one or two species entering the western borders of the Amazon basin,

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but is not treated here as the bulk of the species are Central American. One isolated Central American species T. punctipleura Hine is included because of its apparent similarity to T. nebulosus and T. olivaceiventris which extend into the Amazon basin. Five species described by Kröber and listed in the catalogue (Fairchild 1971) as unrecognized have been reassessed on the basis of their descriptions--the types of all are destroyed or inaccessible--but without enlightenment. The same applies to T. rubidus Macq. whose type is headless. Some of these may be synonyms of species treated here, and very likely of species described here as new species, but I prefer the relative certainty of a name based on a series of good fresh specimens to one based on an unfigured inadequate description of a single damaged specimen which is now lost.

Efforts to divide the unwieldy genus Tabanus have been numerous but largely unsuccessful, as can be seen from the synonymy given in Moucha (1969) or Fairchild (1971). Such efforts will, and probably should, continue, but should not be undertaken without a thorough knowledge of the world fauna.

The species here considered may be divided into several ill-defined groups which seem to share a few characters of possible phylogenetic interest. I briefly discuss them here to call attention to their possible future consideration in any efforts to divide Tabanus into more manageable groups.

T. xenorhynchus group. This includes species with unusually long proboscis, slender flattened palpi, small frontal callus, and usually contrastingly patterned wings and body. Some of the species are known to be arboreal, and others may be. It includes T. xenorhynchus Fchld. from Central America, basilaris Kröb., subviolaceus Fchld. and sannio Fchld. from Brasil and T. unimacula Kröb. from Surinam and Ecuador. T. piceiventris Rond. may also be related here, as it has similar head structures, but lacks wing and body patterns and is not arboreal.

T. nebulosus group. These species have a moderately narrow and generally nearly parallel sided frons with slender clavate or ridge-like callus and a fairly prominent black pilose prescutellar spot. Nebulosus and ssp. ornativentris, glaucus, importunus, olivaceiventris, comosus, guyanensis, punctipleura and perhaps lutzi and corpulentus belong here. The abdomens generally lack any pattern beneath.

The pellucidus group contains species with very narrow frons convergent below, threadlike black callus, abdomen generally with a broad dark pilose median stripe below and often median and dorsolateral pale spots dorsally. The wings have first posterior cell often narrowed or closed, antennae black and usually with a prominent dorsobasal tooth. Species included are: pellucidus, amazonensis, augustifrons, discus, crassicornis, xuthopogon, discifer, nematocallus and probably fuscus.

The fortis group. This appears to include but 3 species, fortis, casteetus and aaptus, with similar narrow frons and head characters, patternless abdomens, no prescutellar spot, and brown tinted wings. All 3 are large stout species with entirely orange antennae. T. itaituba may go here also, though its slender long spined antennae are rather distinctive.

The indecisus group contains only indecisus and antunesi. Both have a distinct round basal callus, slender black antennae, bicolored legs and bicolored fore tibiae, and abdomens with a middorsal row of pale pilose triangles.

The remaining 3 species, duckei, humboldti and aurora, do not seem to belong in any of the groups above, nor to be clearly related to each other.

Names of museums where type material is to be deposited are abbreviated as follows: British Museum (Natural History) London, England: B.M.; National Museum of Natural History, Washington, D.C.: U.S.N.M.; Museum of Comparative Zoology, Cambridge, Mass.: M.C.Z.; Instituto Nacional de Pesquisas da Amazonia, Manaus, Brasil,: I.N.P.A.; Museu Paraense Emilio Goeldi, Belem, Pará, Brasil,: Mus. Goeldi; Florida State Collection of Arthropods, Gainesville: F.S.C.A.; American Museum of Natural History, New York: A.M.N.H.; California Academy of Sciences, San Francisco: C.A.S.

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KEY TO FEMALES

1. Frons very narrow and convergent below, frontal index
 10 or greater, divergence index greater than 1.7.
 Frontal callus a slightly clavate ridge. At least third
 antennal segment wholly velvety black. No appendix
 at fork of third vein 2
 Frons broader, index generally less than 8, and without
 the above combination of characters 10
2. First posterior cell of wing open, at most slightly
 narrowed towards wing margin 3
 First posterior cell strongly narrowed, closed or petiolate.
 Wings heavily fumose or veins brown margined 8
3. Wings hyaline, at most the costal cell faintly yellowish
 to orange 4
 Wings brownish tinted or the veins brown margined or
 basal 2/3 of wing blackish. Costal cell strongly
 yellowish to brown 5
4. Antennal tooth long, several times longer than its basal
 width. Prescutellar black spot prominent, margined

- laterally with white hair tufts. Abdomen with 3 rows of prominent white pilose spots. Costal cell hyaline, not tinted amazonensis
- Antennal tooth short, not longer than its width at base. Prescutellar black spot obscure, without prominent lateral white hair tufts. Median abdominal white pilose spots weak, often not evident, dorsolateral spots small but prominent. Costal cell yellow to orange, clearly contrasting with rest of wing angustifrons
5. Beard and pleural pilosity yellowish to orange brown 6
Beard and pleural pilosity white to gray 7
6. Wings with basal 2/3 to end of discal cell dark brown to black, with centers of some cells paler. Third antennal segment often reddish basally. Mesonotum and scutellum with abundant orange hairs. Abdomen black with prominent white pilose dorsolateral spots, but median triangles faint or absent. Frontal index often less than 10 discifer
Wings faintly brownish tinted, the costal cell yellow to orange, but no extensive basal black coloring. Third antennal segment wholly black. Mesonotum and scutellum brown with brown pollinosity and yellowish hairs. Abdomen brown, black haired, with or without median and dorsolateral yellow to orange pilose spots xuthopogon
7. Abdomen brown, black haired, at most faint vestiges of pale hair fringes on hind margins or elongate median pale pilose triangles, but without dorsolateral spots discus
Abdomen brown to black, with large and prominent pale pilose round dorsolateral spots and smaller pale pilose median triangles on at least terga 2 to 5 crassicornis
- 8(2). Abdomen dark brown to black, bluish pruinose. Beard and pleural pilosity yellow to brown. Abdominal pale pilose markings limited to dorsolateral spots on terga 2 to 5, often absent. Dorsal antennal tooth often longer than width at base. Antennae sometimes brown. Frontal index generally less than 10 fuscus
Beard and pleural pilosity gray to white. Median dorsal abdominal triangles often present. Frontal index very seldom less than 10 9
9. Legs, thorax and abdomen with brown integument, the scutellum often reddish apically. Pale pilose abdominal spots large, both median and dorsolateral spots equally prominent in undenuded specimens pellucidus
Legs, thorax and abdomen with black integument. Pale pilose abdominal spots reduced, the median spots often absent, the dorsolaterals small, weak and often evident only on terga 3 to 4, rarely wholly absent nematocallus

- 10(1). Proboscis unusually long, nearly head height, the stylets at least twice length of palpi, the latter long, flattened and with an acutely drawn out apex. Wings with a dark pattern, sometimes faint. All legs entirely black 11
- Proboscis not greatly exceeding palpi, or if so, then palpi short, legs not wholly dark or a dark pilose spot on prescutellum 16
11. Abdomen without conspicuous white median triangles; at most with vestiges of pale hairs on first and second terga. Sterna orange or yellow pilose. Wing with at most costal cell, basal cells and a streak along R_{2+3} to fork more or less infuscated. Mesonotum not conspicuously striped 12
- Abdomen with conspicuous white dorsal markings; ventrally white or black and white pilose. Wings with a more extensive dark pattern, at least with dark clouds at ends of basal cells. Mesonotum with white stripes or spots . . . 13
12. Frons narrower, index ± 6 . Prescutellum with a small black pilose patch, bounded laterally with short orange hairs. Scutellum with orange hairs laterally and apically, otherwise dorsal surface of brown mesonotum and abdomen wholly black pilose contrasting with orange pilose abdominal venter piceiventris
- Frons broader, index 5.6. Prescutellum without such a black pilose patch. Mesonotum with faint pale pollinose patches at ends of transverse sutures. Abdomen with faint vestiges of orange mid-dorsal pilose triangles on at least first 2 terga but venter black pilose subviolaceus
- 13(11). Scutellum dark brown, dark pollinose and black pilose. Wings with costal and basal cells and all veins at base of wing including those at apex of basal cells more or less infuscated. Mesonotum with 3 slender whitish stripes and white hair tufts on margins of mesonotum posterior to wing bases. Abdomen with a middorsal row of small white pilose triangles on terga 1 to 5, largest on 4, and with more or less evident white pilose posterolateral angles of terga 1 to 4 basilaris
- Scutellum extensively white pilose. Wings with a conspicuous dark pattern. Mesonotum and abdomen with more extensive white pattern 14
14. Scutellum entirely white pollinose and pilose. Frons broader, index less than 5.5 15
- Scutellum basally blackish, only margin white. Frons narrower, index greater than 6.5. Mesonotum brown, margined with white pilosity and with 2 narrow faint whitish dorsal stripes. Abdomen with small white pilose triangles on terga 1 and 2, 4 to 6, that on 4 much larger than the others. Wing light brown in basal and anal area and distal

to end of stigma, fork, and discal cell, leaving area
between ends of basal cells and fork of third vein and
end of discal cell transparent. All crossveins
surrounded by much darker large blackish clouds
. xenorhynchus

15. Frons broader, index 4.3-4.6. Mesonotum blackish with a broad
median white pollinose and pilose stripe the width of
scutellum covering its whole length. Abdomen with terga 1
wholly white pilose, terga 2 and 4 with large white median
triangles the length of their segments, 3, 5 and 6 with
smaller white triangles and all terga with narrow white hind
margins broadened at sides to nearly length of segments.
Wings hyaline with dense black spots on all crossveins, a
spot near apices of marginal and first submarginal cells,
and small discrete spots in middle of discal cell and all
posterior cells. sannio
Frons narrower, index 5 or greater. Mesonotum all white
pilose with a faint broad middorsal dark streak. Abdomen
black above and below with a white trapezoid dorsally on
tergum 4 only. Wings basally infuscated to end of stigma and
with a spur to fork of third vein. Discal and 2nd basal cells
subhyaline centrally unimacula
- 16(10). With a well marked black pilose prescutellar spot framed
laterally with tufts of paler hair and/or pollinosity 17
Without such a spot 26
17. Wings with strong dark clouds surrounding all crossveins and
fork of 3rd vein. First posterior cell more or less
strongly narrowed or coarctate but not closed. Fore
tibiae bicolored, paler at base than apex and remaining
tibiae paler, at least basally, than respective femora.
Abdomen brown with a more or less complete middorsal
integumental black stripe or series of spots and whitish
dorsolateral oblique pilose dashes ornativentris
Wings at most with veins diffusely brown margined, or darker
basally or fork with small and weak cloud 18
18. Abdomen, when undenuded, dorsally without median or dorso-
lateral pale pilose spots, patches or median triangles . . . 19
Abdomen when undenuded with discrete pale pollinose markings
and sometimes also with dark integumental markings 21
19. Antennae with a long forward pointing dorsal spine on basal
plate. Wings uniformly light brown. Proboscis but slightly
exceeding palpi. Pleura with conspicuous black hair tuft
below wing base. Abdomen black, bluish pruinose, black
pilose, the posterolateral corners of terga 1 to 4 or 5
with creamy hair tufts. punctipleura
Antennae with at most an acute dorsal angle. Proboscis much ex-
ceeding palpi. Pleura with at most a weak dark hair tuft. . 20

20. Abdomen with integument light to dark brown, occasionally with a black streak on first 2 terga, wholly black pilose dorsally, orange to yellow pilose ventrally. Antennae very dark brown to black. Pleura and beard yellowish gray to black. Wings with basal and costal cells, area below stigma and a streak along 3rd vein to fork more or less blackish infuscated piceiventris
Abdomen orange brown in ground color, dorsally orange pilose except in the middle of terga 4 to 7, where the pilosity is increasingly black. Pleura and beard yellowish brown, legs black, antennae orange with dusky style, callus clavate, wings clear, slightly brown tinted in costal cell and basally lutzi
- 21(18). Abdomen light yellow to leaf green in ground color with a faint median and a pair of dorsolateral pale haired stripes or rows of spots. Legs yellowish brown. Wings glass clear or the veins weakly brownish margined. Mesonotum pale gray pollinose olivaceiventris
Abdomen not green, usually with an obvious pattern of pilosity 22
22. Abdomen with a middorsal black pilose stripe which may be underlain by a dusky integumental stripe or series of spots. Broad interrupted dorsolateral stripes or rows of orange pilose spots on terga 1 to 5 or 6 are bordered outwardly by black pilose stripes and extreme lateral borders of terga 1 to 5 pale pilose. Palpi extremely short and broad. Wings with faint cloud at fork and more or less infuscation below stigma importunus
Abdomen with at least vestiges of pale pilose median triangles 23
23. Mesonotum with a dorsolateral pair of dark stripes or abdomen with large and conspicuous white pilose median triangles. . 24
Mesonotum not conspicuously striped and median abdominal triangles small, inconspicuous or yellowish 25
24. Wing glass clear. Mesonotal stripes faint. Abdomen with a median row of short equilateral white pilose triangles and broad dorsolateral white pilose stripes from terga 1 to 5 or 6. Legs entirely pale, white pilose. Palpi white, wholly white pilose comosus
Wing with costal cell orange, calypters and basal cells dusky. Mesonotal dark stripes conspicuous. Abdomen with tall, conspicuous white median triangles on terga 1 to 4 and slender interrupted white pilose dorsolateral stripes. Legs dark brown to black, mainly black pilose. Palpi yellowish, often partially black pilose guyanensis
- 25(23). Mesonotum and scutellum with blackish integument, slightly bluish pollinose. Abdomen dark brown with nearly always

- a black integumental median triangle on first 2 terga.
All femora usually black, contrasting with reddish
tibiae. Wings smoky, the costal cell orange, but no
spot at fork of 3rd vein. Median abdominal triangles
yellow, slender, nearly forming a stripe. Dorsolaterals
a row of orange pilose spots. Frons parallel sided or
slightly narrowed above glaucus
Mesonotum and scutellum with reddish brown integument,
light brown pollinose. Abdomen brown, usually without
a well marked dark integumental streak on terga 1 and 2.
Femora usually not or but little darker than tibiae, sometimes
the fore pair black, rarely all tibiae more or less black.
Wings as in glaucus, but nearly always a small cloud at
fork of third vein, and the costal cell hyaline. Abdomen as
in glaucus but middorsal triangles broader and fainter,
dorsolateral orange spots larger, rarely confluent. Frons
widened above, divergence index greater than 1.10
. nebulosus
- 26(16). Abdomen with a conspicuous middorsal row of large yellow
pilose triangles, nearly contiguous from terga 1 to 4 or
5, and fainter yellow pilose dorsolateral stripes from
terga 2 to 6. Legs obscurely bicolored, femora blackish,
tibiae reddish. Fore tibiae basally nearly white. Wings
smoky. Third antennal segment black. indecisus
Abdomen at most with small inconspicuous median hair
tufts 27
27. Abdomen with small, easily lost, median pale hair tufts or
triangles on at least terga 1 to 4 28
Abdomen without contrasting median triangles 30
28. Antennae orange, the style dusky, basal plate broad with a
strong dorsal angle or short tooth. Mesonotum and
scutellum blackish; abdomen orange brown, the median
triangles dull yellowish on terga 1 to 6, easily lost.
Beard and pleura white pilose humboldti
Antennae black 29
29. Antennae slender, the dorsal tooth close to base of plate.
Median orange abdominal hair tufts on terga 1 to 4 only.
Beard and pleural pilosity yellow to brown antunesi
Antennae with a strong, curved dorsal spine. Median white
abdominal hair tufts broad, on terga 1 to 6 duckei
- 30(27). Antennae orange, the style dusky, slender, with a long forward
projecting dorsal spine. Whole insect orange brown and
all pilosity dark yellow. Wings evenly pale brown. . . itaituba
Antennae and body not as above. 31

31.

Wings with costal cell orange, basal cells and calypters lightly infuscated, rest of wing hyaline. Whole insect reddish brown

32

Wings evenly fumose or all veins broadly brown margined . . .

33
32.

Antennae with a strong dorsal angle or sharp tooth near base of basal plate. Frontal callus long oval, generally separated from the slender ridge-like median callus by a pollinose gap.

corpulentus

Antennae with a weak dorsal angle near middle of basal plate. Frontal callus a gradually tapering ridge with no distinction between frontal and median callus

aurora
- 33(31).

Wings with all veins broadly brown margined. Antennae orange, the dorsal angle obtuse. Abdomen dark brown, bluish pruinose, black pilose above and below except for hind margins of all terga and sterna coppery red pilose, as is rest of insect including beard and palpi

casteetus

Wings lightly and evenly fumose. Beard not red

34
34.

Beard and pleural pilosity very dark brown. Femora dark brown, black haired, tibiae paler, red haired. Abdomen nearly black, black pilose except for narrow dark red pilose hind margins on all segments. Wings with venation normal, dark smoky. Thorax and scutellum very dark brown

fortis

Beard and pleural pilosity yellowish white to gray. Femora black, tibiae yellowish to reddish. Abdomen as in fortis, except the pale pilosity orange to yellow. Wing less darkly fumose, the fork of third vein with a short but constant appendix. Thorax and scutellum as in fortis, except marginal pilosity gray rather than black

aaptus

SPECIES DISCUSSION

TABANUS AAPTUS n. sp. (Fig. 29, Map 5)

A large dark brown species with slender orange antennae, whitish beard, bicolored legs and lightly tinted wings with a short appendix at fork of third vein.

Female. Length 20 mm., of wing 17 mm. Eyes bare, color or pattern not recorded. Head structures as figured. Frons yellowish brown pollinose, darker at vertex. A strong occipital fringe of unevenly sized strong black spines. Callus reddish brown, its upper extension black. Subcallus orange gray pollinose, wrinkled, becoming grayer on frontoclypeus and genae. Hairs of face and beard pale gray with a few blackish hairs at sides of antennal insertions. Antennae orange, the scape gray pollinose, both scape and pedicel with strong black dorsal setae, finer, sparser and paler hairs below. Third segment orange, the annuli darker, nearly black. Palpi light orange, thinly pollinose, the basal segment white pilose, the distal segment short black pilose. Proboscis less than head height, blackish, membranous, the labella long as palpi.

Mesonotum with integument blackish brown, the notopleural lobes and sides of scutellum reddish. Vestiture of gray pollinosity, faintly striped, erect black hairs and semi-recumbent dull orange hairs, the latter also forming faint stripes. No tuft of black hairs between mesonotum and scutellum, but a small tuft of gray hairs just behind wing bases. Pleura dark, light gray pollinose and white or pale gray pilose. Coxae and femora black, the first white haired, the last dorsally black haired, ventrally long white haired, the apices of mid and hind femora yellowish. Tibiae orange brown, the fore pair yellow haired except at apex, the 2 hind pairs dark haired. All tarsi dusky. Wings with costal cell orange, rest of wing lightly tinted, especially in basal cells and below the yellow stigma. Fork of third vein with a short appendix, rarely longer than the subtending vein segment. First posterior cell slightly narrowed. Halteres with orange stem and ivory white knob.

Abdomen with dark orange brown integument, clothed dorsally with blackish pollinosity and short black pilosity except for narrow fringes of bright copper colored hairs on hind margins of terga 1 to 6. Beneath the integument seems paler due to whitish pollinosity. The terga are sparsely dark pilose and with broader hind marginal bands of paler yellow hairs.

Holotype female, Brasil, Amazonas, vic. Manaus, Reserva Ducke 17-VIII-1981, flight trap, Fairchild, Rafael and Gorayeb colls. To be deposited in I.N.P.A.

Paratypes 26 females, same locality and collectors, 22-VII and 14, 17-VIII 1981, all but one taken in a flight trap. The paratypes are very similar but vary somewhat in size, from 17 to 20 mm, with wing lengths of 14 to 16.5 mm. Wings also vary somewhat in intensity of infuscation, a few having the veins quite noticeably brown margined.

A single male (Allotype) taken with the paratypes is quite puzzling, as its coloring is much like fortis. It seems the males are more similar than the females in this pair of species.

Male. Length 21 mm., of wing 16.5 mm. Eyes bare, holoptic, the color or pattern not recorded. Upper facets well differentiated from lower, but not sharply demarcated, occupying a central patch of about 1/2 total eye area. Head structures as figured. A small scale-like tubercle sunk between the eyes at vertex. Pollinosity of frontal triangle orange brown, darker than in holotype of aaptus, about as in females of fortis. Pollinosity of fronto-clypeus and genae dark brownish gray, the beard dark brown. Antennae orange, more slender than in female, only the terminal annulus black. Palpi dark reddish brown, black pilose. Coloration of body, legs and wings about as in female aaptus except that pollinosity of pleura is darker gray, and pilosity of pleura and legs is orange brown where it is white or gray in female aaptus. Abdomen is quite pointed, with color and vestiture dorsally as described for female, though light pilosity is sparser and darker. Beneath the abdomen appears darker due to lack of pale pollinosity and denser and more extensive black pilosity. The wings have a trace of an appendix in the right wing, none in the left. The damaged male mentioned in the discussion of T. fortis differs from the male here described in having no vestige of an appendix at fork of third vein, in having all legs with integument dark reddish, but pilosity of femora black, of tibiae reddish to yellow, rather than integument of femora black, tibiae red as in aaptus. There is no hint of gray pollinosity on pleura or coxae in this specimen, and I believe it is the male of fortis.

The name is from Greek aaptos, invincible, to indicate its close relationship with fortis.

T. aaptus differs from T. fortis in slightly smaller average size, whitish beard and pleural vestiture, presence of a short appendix at fork of third vein, less heavily tinted wings, and the pale pilosity of legs and abdomen is consistently paler, whitish to orange rather than deep reddish. The basal plate of antenna is also more slender and lacks the ventral angle generally present in fortis. The legs in both species are more or less bicolored, but in aaptus this is due largely to the color of the integument, while in fortis it is due largely to the color of the vestiture.

TABANUS AMAZONENSIS (Barretto) (Fig. 1, Map 10)

Lophotabanus albopruinosus Kröber 1930, Zool. Anz. 90(3-4):85-86, female, Brasil.

Tabanus (Lophotabanus) albopruinosus Kröber 1934, Rev. Ent. 4(2-3):295.

Fairchild 1966, Stud. Ent. 9(1-4):362. Not Tabanus (Ochrops) albopruinosus Szilady 1923, Biol. Hung. 1:6.

Chelommia amazonensis Barretto 1949, Rev. Brasil. Biol., 9(1):41-43, figs. 4-6, female, Brasil, Amazonas, Manaus.

Tabanus amazonensis: Fairchild 1971, Cat. Dipt. Amer. S. of U.S., 28:99, as syn. of T. pellucidus Fab.

A large blackish species with very narrow frons, a long dorsal spine on black third antennal segment, a small black pilose prescutellar spot framed laterally by prominent white hair tufts, largely brown legs, faintly fumose to nearly hyaline wings with first posterior cell only slightly narrowed, black pilose abdomen with 3 rows of small white haired spots above, mainly white pollinose and pilose beneath, but with a faint dark pilose median longitudinal broad stripe or series of patches, absent in some denuded specimens. Old and faded specimens become purplish brown. The eyes are greenish black in life, without pattern. The species can be separated from others of the pellucidus group by the long dorsal antennal spine, prominent white hair tufts on each side of prescutellum and hyaline costal cell. I have a series from Reserva Ducke near Manaus and Campina Reserve n. of Manaus, taken in flight traps in August 1981 and 1 from Reserva Ducke, 30-VI-1970, T. Pimentel coll. An old specimen from Javareté, XI-1934, E. Amazonas was determined as this species by me in 1952. Barretto (l.c.) reports it also from São Gabriel, on the upper Rio Negro. I have seen Kröber's poorly preserved types but not those of Barretto.

TABANUS ANGUSTIFRONS Macquart (Fig. 2, Map 10)

Tabanus angustifrons Macquart 1847 Dipt. Exot. Suppl. 3:12, female, Cayenne.

Tabanus alboater Walker 1850, Newman's Zoologist 8, App. p. LXVII, female, Brasil. Fairchild 1956, Smiths. Miscell. Coll. 131(3):40. Philip 1960, Proc. Calif. Acad. Sci. 31(3):98.

Tabanus atricornis Bigot 1892, Mem. Soc. Zool. France, 5:638, female, S. America. Not Meigen 1838. Fairchild 1956, Smiths. Miscell. Coll. 131(3):10, 11. Syn. of alboater Walk.

A species closely similar to T. amazonensis, differing mainly in the shape of the black antennae which do not have the long dorsobasal tooth or spine found in amazonensis. The wings are hyaline, but costal cell yellowish, the legs are largely black to dark brown, especially the femora, and the mid abdominal dorsal pale hair triangles are smaller and less evident than in amazonensis, though the dorsolateral spots are clearly present. The pre-scutellar black spot is also less evident and the prominent white hair tufts are missing or represented by short yellowish hairs. I have a specimen from Brasil, Amazonas, Rio Branco, Sororoca, 1-IX-24, determined as alboater Walk. by J. Bequaert which was compared and found to agree with the type of angustifrons in London in 1953, but since the type is poorly preserved, lacking antennal styles, some doubt remains. I believe alboater is the same, based on a female from Pebas, Peru, which I compared with the type of alboater in B. M. in 1964 and found to agree closely. The specimen certainly belongs to the same species as the one found to agree with the type of angustifrons in 1953. The eye in life is black with greenish reflections. Philip (l.c.) came to the same tentative conclusion although he had not compared angustifrons.

I have studied the following specimens: Peru, Loreto, Pebas no date, 1 female; Loreto, Iquitos, 13-III-64, B.K. Dozier coll., 1 female; Brasil, Amazonas, Rio Branco, Sororoca, 1-IX-24, J. Bequaert, 1 female; Pará, 10 Km. N. Bragança, 10-VII-81, netted, I.S. Gorayeb coll., 1 female; Pará, vic. Belém, 17-22-VI-77, malaise trap, 2 females; Belém, APEG forest, 29-VII to 6-VIII-74, flight trap, D.G. Young, 1 female; Colombia, Meta, Rio Vaupes, Lago El Dorado, XI-68, F. Medem coll., 1 female; Guyane Francaise, Natoury, 18-VIII-79. Raymond leg., 1 female.

TABANUS ANTUNESI n. sp. (Fig. 22, Map 5)

A plain brown species with lightly tinted wings, slender black antennae, and a middorsal abdominal row of small orange haired triangles.

Female. Length 19 mm., of wing 17 mm. Eyes bare, color in life unrecorded. Head characters as figured. Frons orange brown pollinose with rather abundant short decumbent dark brown hairs between median callus and vertex. A strong occipital fringe of stout short black setae is present. Frontal and median frontal calli black and a small partly denuded spot in place of an ocellar tubercle. Subcallus, frontoclypeus and genae yellowish gray pollinose, with a small patch of curved orange hairs below antennal bases and short sparse hairs on upper genae. Beard pale reddish. Antennal scape and pedicel dark brown, grayish pollinose, densely beset with black setae. Third segment entirely velvety black. Palpi pale brown, almost wholly short black pilose, with but a few pale hairs. Proboscis nearly head height, the theca and labella black, membranous.

Mesonotum with dark reddish brown integument, thinly orange gray pollinose and beset with semi-erect black hairs and recumbent orange hairs. The sutures are faintly paler and the notopleural lobes concolorous with dorsum, the latter with dense erect black hairs. Scutellum reddish brown, orange and black haired, and with small tufts of pale hairs above wing bases. Wings hyaline, faintly grayish with faint brownish shades along main veins. Venation normal, a strong angle at fork of third vein and first posterior cell broadly open. Basicosta setose. Stigma yellow. Haltere with brown stem, yellow knob. Pleura and coxae gray pollinose, pale straw colored pilose.

All femora dark brown, dorsally short black pilose, ventrally long pale pilose. Tibiae lighter reddish brown, the fore pair faintly bicolored, with pale hairs basally, black apically. Remaining tibiae reddish pilose, all tarsi blackish. The short outer hind tibial fringe is black.

Abdominal integument concolorous with that of thorax. Dorsally the terga are thinly brown pollinose and densely short black pilose, except for very small dark orange hair tufts on the middle of the hind margins of terga 1 to 4 and a few yellow hairs on extreme posterolateral margins of terga 3 and 4. Beneath the sterna are largely yellow pilose, but with the centers of all segments black pilose, resulting in the appearance of a broad midventral dark pilose band or stripe.

Holotype female, Ilhéus, Bahia, Brasil 18-VIII-1934, A-32, P.C.A. Antunes coll. Holotype and some paratypes to be deposited in Museu Goeldi.

Paratypes 12 females, same locality and collector, Nos. A-31, A-32 and A-34. The paratypes vary from 16 to 20 mm., but are quite uniform otherwise. The orange middorsal hair tufts are easily lost and not evident on rubbed specimens.

This species is very similar to T. indecisus, having the head structures practically identical. Indecisus, however, has large yellow to whitish pilose middorsal abdominal triangles and generally dorsolateral pale spots and pale pilose hind tergal margins. The species is named for Dr. Paulo C. de Azevedo Antunes, the collector of this and many other interesting haemato-phagous insects.

TABANUS AURORA Macquart

Tabanus aurora Macquart 1838, Dipt. Exot. 1(1):142(138), female, Brasil.

Fairchild 1967, Pacific Ins. 9(2):244, fig. 2. Syntypes in Paris.

I have seen no specimens other than the 2 syntypes in Paris. The specimens reported as aurora by Bequaert (1926) and Kröber (1929) were apparently Phaeotabanus innotescens Walker, while specimens standing under aurora in Lutz collection belonged to 3 different species, only one of which agreed with my notes on the types and none of which were innotescens (Fairchild 1961). The original description is not diagnostic, referring only to color. My notes (l.c.) indicate a species resembling T. fuscus Wied., but with different antennae and frons. It can apparently be separated from lineifrons Lutz, whose antennae seem to be very similar, by not having an appendix at fork of third vein and by having red legs and antennae. The species is the type species of Lutz' genus Odontotabanus, as designated by Borgmeier (1933). The range is unknown, and neither of the syntypes bears any indication of locality, date or collector.

TABANUS BASILARIS Kröber (Fig. 13, Map 7)

Tabanus basilaris Kröber 1931, Konowia 10:291, female, Brasilien.

Fairchild 1961, Mem. Inst. Osw, Cruz 59 (3):293; 1966, Studia Ent. 9(1-4):372. Type in Vienna.

The species can be separated from other large dark species by the remarkably long proboscis, the stylets equalling head height, long pointed and flattened palpi, wholly black legs and yellowish white halteres. It belongs

structurally to a small group which includes T. xenorhynchus Fchld., T. subviolaceus Fchld., T. sannio Fchld. and T. unimacula Kröb. It differs from subviolaceus in bearing a middorsal abdominal row of small white pilose triangles, having white hair tufts above the wing bases, more or less distinctly gray striped mesonotum, and pale hair patches at sides of at least first 4 abdominal terga. The abdomen also is white pilose beneath. The head characters are much like those figured by me for subviolaceus (Fairchild 1961), but the palpi are notably broader. All specimens seen aside from the type have been from São Paulo or Minas Gerais, taken in Dec. or Jan. A single male, Peru, Madre de Dios, Rio Tambopata Reserve, 30 km. S.W. Pto. Maldonado, 16-20XI-79, J. B. Heppner coll. seems to agree with the few available females, though the great distance from other known localities for the species renders the identification tentative.

TABANUS CASTEETUS nom. nov. (Fig. 24, Map 8)

Tabanus testaceus Macquart 1838, Dipt. Exot. 1(1):137, female, Cayenne.

Fairchild 1956, Smiths. Miscell. Coll. 131(3):30; 1967, Pac. Ins.

9(2):251; 1971, Cat. Dipt. S. Amer. S. of U.S. 28:109, not recognized.

Surcouf and Gonzalez Rincones 1912, Dipt. Vuln. Venez, 2 ieme partie, pp. 70, 71-72, fig. 41. Venezuela, Cagua. Not Tabanus testaceus

Forskal 1775.

In 1964 I was able to compare specimens with the type in Paris, which is in very poor condition and completely denuded, as noted in the original description. My compared specimen is from Taracua, Rio Vaupes, Amazonas, Brasil, 3-1-1924, Melin coll. and agreed fairly well with the type, as far as condition of the latter allowed valid comparison. This is the specimen figured here. The species resembles a faded T. fortis Fchld., but has the wing veins broadly brown margined, halteres with pale knobs, all cells open, the abdomen bluish pruinose and antennae and frontal callus are both different. The legs are entirely reddish and red pilose, and, with the exception of a small tuft of golden yellow hairs beneath the wing base, all the pilosity of head and body is coppery red. The name is an anagram of testaceus.

The reference in Surcouf and Gonzalez-Rincones includes a figure, indicating an almost completely denuded specimen, but they include no additional descriptive matter, merely quoting Macquart's original description and saying they received a dozen specimens from Cagua, Venezuela, from Dr. Rangel. Kröber's reference (1930) to a type in B. M. refers to another species.

TABANUS COMOSUS Stone (Fig. 19, Map 8)

Tabanus comosus Stone 1944, Bol. Ent. Venezolana 3(3):134, female, Venezuela.

I have a topotype determined by Stone and 2 other females from Venezuela. The species is structurally much like guyanensis Macq., but smaller, grayer, with a strongly marked prescutellar black spot and broad white pilose median and dorsolateral rows of abdominal spots. Legs

are pale yellowish, nearly wholly white pilose. Wings glass clear, the veins light brown.

TABANUS CORPULENTUS Brèthes (Fig. 26, Map 2)

Tabanus corpulentus Brèthes 1910, An. Mus. Nac. Buenos Aires 20:480 (preprint Dec.); 1911, Op. cit. Ser. 3, Tomo XIII, 480; 1921, Estudios 21(3 et seq.):67, female, Misiones Argentina. Coscarón 1979, Obra Cent. Mus. La Plata, 6:262-263, figs. 3G to 3K.

Tabanus neoinnotescens Kröber 1931, Konowia 10(4):299, female, Brasil. Fairchild 1966, Studia Ent. 9(1-4):373; 1971, Cat. Dipt. Amer. S. of U.S., fasc. 28:9, as syn. of corpulentus.

The above synonymy was based on comparison of a homotype of neoinnotescens from Villarica, Paraguay, with a specimen from the same locality determined as corpulentus by Coscarón. This is a large wholly reddish brown and rufous pilose species often confused with T. fuscus Wied. I have a specimen from Rio Tamandua, Rib. Preto, S. Paulo determined by Barretto as T. impressus Wied., a synonym of fuscus. The latter differs from corpulentus in being generally darker, with blackish abdomen, black antennae and legs, and in having the first posterior cell in the female wing always closed and usually petiolate, though in the males we have seen it is often narrowly open.

The male, hitherto undescribed, is readily associated with the female on color and size. The eyes are holoptic, bare, with a well demarkated area of enlarged facets occupying about 2/3 of total eye area and a small thin tubercle sunk between the eyes at vertex. The palpi are curiously spatulate. Whole insect is reddish brown, clothed with brown pollinosity and orange brown pilosity. The wings are clear, the costal cell and both basal cells yellowish tinted, the stigma yellow and first posterior cell wide open.

Plesiotype male, Brasil, São Paulo, San José dos Campos, XII-1954, H. S. Lopes.

I have seen the following specimens: Paraguay, Villarica, F. Schade, no date, 2 females; Brasil, Paraná, margem do Rio Piquiry 30-I-1918, 1 female; Paraná, Guairá, XI-1941, 1 female; Mato Grosso, Maracaju, Feb. 1937, 1 female; São Paulo, Ribeirão Preto, Rio Tamandua, Barretto and Zago coll., 10-XII-53, 1 female; São Paulo, S. José dos Campos, H. S. Lopes, XII-1934, 1 male.

TABANUS CRASSICORNIS Wiedemann (Fig. 7, 8, Map 11)

Tabanus crassicornis Wiedemann 1821, Dipt. Exot. 1:71; 1828, Auss. Zweifl. Ins. 1:130, female, Amerika. Fairchild, 1967, Pac. Ins., 9(1):96, fig. 18, syn. of pellucidus Fab. Philip 1960, Proc. Calif. Acad. Sci., Ser. 4, 31(3):97-98.

Chelommia melanocnemis Barretto 1957, Rev. Brasil. Malar. 8(1):83-84 (1956), ? in part.

This species is most similar to pellucidus, differing from that taxon in having the wings less strongly brownish and with the first posterior cell

open, only slightly narrowed. The costal cell is strongly brown tinted. Wiedemann's description was drawn from an admittedly old specimen standing under the name of rufiventris in Fabricius' collection, and he did not know its provenance other than "Amerika." The name is not listed in Kröber's catalogue (1934) while Stone (1938, p. 164) mentions it as possibly nearctic, though he did not recognize it. My specimen compared and agreeing with the type in Copenhagen is from Surinam, and I think it likely that Wiedemann's type may also have been from that country, as much of Fabricius' material seems to have been from there. It is very probable that crassicornis is based on a faded specimen of pellucidus with the first posterior cell more than usually widely open. I have 2 pellucidus from Zanderij Id., Surinam and 2 crassicornis from Republiek, Surinam. Philip (1960) discussed this Copenhagen specimen, but without definitely placing it, though it is the second oldest name in the group.

Specimens at hand are from the following localities: Suriname, Republiek, Sept.-Oct. 1963, Geijskes coll., 4 females; Guyane Francaise, Acarouany, 2-IX-80, Raymond leg. 1 female; Brasil, Amapá, Serra do Navio, Sept.-Oct. 1957, J. Lane coll., 2 females; Pará, Belém, Utinga, 27 Nov. 1974, D. R. Roberts, 3 females; same loc., 21 Nov. 1974, 1 female, Pará, vic. Bacuri n. of Marabá, 26, 30 Oct. 1974, J. F. Reinert coll., 2 females.

TABANUS DISCIFER Walker (Fig. 3, Map 9)

Tabanus discifer Walker 1850, Insect. Saunders. Dipt. 1:35, pl. 2, fig. 2.

Female, Para. Fairchild, 1971, Cat. Dipt. Amer. S. of U.S. 28:91, synonymy.

I have seen the types of all the names listed in synonymy in the catalogue. Kröber (1929) described and figured the male as T. guttiventris. The species is easily recognized by having the wings basally to end of discal cell largely blackish, usually with lighter areas in the centers of most cells and a dark extension to fork of third vein. The frons is narrow, like the rest of this group, the antennae black or dark brown with a strong dorso-basal tooth, though not as long as in amazonensis Barr. Mesonotum is black, but in undenuded specimens with abundant orange hairs. Notopleural lobes reddish, and scutellum often with reddish apex and margins. Beard and pleura yellowish to brown, never gray or white. Abdomen brown to black strongly bluish pruinose on anterior tergites, black pilose except for dorso-lateral round white pilose spots on tergites 2 to 5. No median white triangles in most specimens, and when present they are small and faint. Legs black and abdomen beneath black with variably prominent sublateral white stripes. The male is similar, more brownish in integument and the antennae brown with black style, eyes bare, holoptic, the large facets well differentiated and demarcated, occupying about 1/2 eye area. The female eye in life is said to be dark greenish with reddish highlights, without bands. Most of my material was taken in flight or malaise traps, a few biting cattle at dusk, the male at light. The distribution of specimens before me is shown on map no. 9.

TABANUS DISCUS Wiedemann (Fig. 6, Map 12)

- Tabanus discus Wiedemann 1828, Auss. Zweifl. Ins. 1:123-124, female, Brasil. Fairchild 1967, Pacific Ins. 9(1):96-97, fig. 19, synonymy; 1971, Cat. Dipt. Amer. S. of U.S. 28:91.
- Chelotabanus discus: Kröber 1932, Rev. Ent. 2(3):294-295, discussion not based on type; 1934, Rev. Ent. 4(2):261.
- Tabanus rufoniger Walker 1850, Ins. Saunders., Dipt. 1:66, female, unknown locality. Fairchild 1967, Pac. Ins. 9(2):251, synonymy.
- Lophotabanus communis Kröber 1930, Zool. Anz. 90(3-4):83, female, Surinam. Fairchild, 1966, Studia Ent. 9(1-4):362, synonymy.
- Tabanus cervinus Kröber 1929, Ann. Naturhist. Mus. Wien, 43:254, 255, fig. 13, female, Santarem, Para, Brasil. Fairchild 1966, Studia Ent. 9(1-4):372. (New synonymy).
- Tabanus infuscatipennis Surcouf, 1919, Miss. Serv. Geogr. Armee. Mes. Arc Meridien Equatorial, 10(2):230, nomen nudum. Fairchild 1967, Pac. Ins. 9(2):247.
- Chelommia melanocnemis Barretto 1957, Rev. Brasil. Malariol. 8(1):83 (1956) female, Rio Negro, Brasil and Br. Guiana. ? in part.

A large species with very narrow frons, black antennae, grayish black mesonotum, white beard and pleura, black legs and plain brown abdomen without conspicuous pale dorsal markings. There is a small prescutellar dark spot and a pair of white pilose stripes on the abdomen beneath. The wing veins are more or less conspicuously brown margined, there is no appendix at fork of third vein and the first posterior cell is at most slightly coarctate. The eyes in life are greenish black, without pattern. In a few exceptionally well preserved specimens a faint row of narrow white haired middorsal triangles nearly forming a narrow stripe may be seen, or there may be a few pale hairs on the hind margins of one or more tergites. I have not seen males of this species.

T. discus differs from other members of the pellucidus group chiefly in the almost total absence of pale pilose markings on the brown abdomen above. Distribution, based on specimens actually seen, is shown on the accompanying map. The Trinidad and Venezuela localities in Fairchild (1971), though quite likely, cannot now be confirmed and are omitted from the map.

I have a specimen from Surinam compared and agreeing with a paratype of melanocnemis Barr. from Br. Guiana in B.M., but it does not agree well with the original description. Unfortunately, Barretto does not mention the condition of the first posterior cell and does not figure the species, nor does he mention the condition of his specimens. I believe that at least the Guyana paratypes may be what is here called T. discus Wied.; the holotype from Rio Negro may be different, but I have not seen it. My compared specimen from Surinam was also compared and found to agree with the types of rufoniger Wlk., communis Kröber, and the undescribed infuscatipennis Surcouf.

A specimen from Iquitos, Peru, which I thought was in only fair agreement with the type of cervinus Kröb. in Vienna in 1964, differed from the type in having yellowish brown beard and pleura, while in the type these are whitish. Another compared specimen from Pará differed in having the abdomen beneath all dark haired, lacking the white pilose stripes of the

type. I now feel that cervinus is but a specimen of discus with the median pale triangles better preserved than usual.

My notes on the type of rufoniger indicate that first posterior cell is "practically closed at wing margin," i.e. very narrowly open. This is probably but an extreme variant, as all other characters seem to agree with discus.

Kröber's redescription of the species (l.c. 1932) was not based on the type in Berlin, but on a specimen thought to be determined by Bischoff in Vienna. This specimen was not discus in the present sense, as it had both a closed and stalked first posterior cell and white spots on the abdomen above. The type and my material would key to impressus in the key furnished by Kröber in this publication. This misdetermination may have been the reason for Kröber's proposals of cervinus and communis, both of which seem to have been based on slight variants of discus. Specimens I had compared with the type of cervinus differed from both discus and Kröber's type in having yellow pilosity, and I now believe they represent a different species, described herein as xuthopogon n. sp.

TABANUS DUCKEI n. sp. (Fig. 23, Map 6)

An inconspicuous brownish species with black antennae, bicolored fore tibiae, lightly tinted wings, ridge-like or clavate frontal callus and median pale hair tufts on abdominal tergites 1 to 5.

Female. Length 18 mm., of wing 16 mm. Eyes bare, the color and pattern not recorded. Head structures as figured. Frons yellowish gray pollinose, the callus reddish brown. Occipital fringe of short black setae. Subcallus, frontoclypeus and genae with orange brown integument, yellowish gray pollinose, appearing more reddish than frons. Beard white. Scape and pedicel of antennae reddish brown, pollinose, densely black setose. Third segment velvety black, only extreme base of plate dark reddish. Palpi pale orange, pale pollinose, almost wholly dark haired, even the first segment. Proboscis nearly head height, the labella as long as palpi, both theca and labella dark brown, fleshy.

Mesonotum with dark brown integument, the sides including notopleural lobes and scutellum reddish and with a small pale spot at ends of the transverse sutures. Dorsal vestiture is of thin gray pollinosity, abundant erect black setae and sparse recumbent yellow hairs. There is a small but dense tuft of short white hairs just posterior and dorsal to wing base, but no vestige of a scutellar or prescutellar dark spot. Pleura white pollinose and with rather sparse long white hairs which also clothe the coxae. Fore coxae and femora nearly black, tibiae with basal 2/3 yellow, short white pilose, distal 1/3 infuscated, black pilose as are tarsi. Mid and hind femora dark brown, white pollinose and white haired, the tibiae paler, reddish, also largely pale pilose but with a hind tibial fringe of dark hairs. Wings with venation normal, no appendix, the first posterior cell very slightly narrowed, the membrane weakly yellowish brown tinted, strongest in costal cell.

Abdomen above chestnut brown, thinly pollinose, the first tergite slightly bluish pruinose when viewed from behind. Dorsal vestiture is of erect black hairs except for short broad median posterior triangles of whitish hairs on tergites 1 to 6 which are underlain by triangles of whitish pollinosity. Extreme sides of tergites 1 to 4 are thinly whitish pilose, the remaining

tergites black pilose. Beneath the sternites are thinly whitish pollinose with the posterior 1/2 white pilose, remainder black pilose.

Holotype female Venezuela Expedition, Territ. Amazonas, Mt. Marahuaca, N. slope, Benitez camp, May 1-25, 1950, J. Maldonado Capriles coll. In F.S.C.A.

Four female paratypes same data. Three female paratypes Serra de Cupaty, Rio Japurá (Caquetá) Colombia, perto da fronteira de Brasil, XI-1912, A. Ducke. To be deposited in Museu Goeldi, Belém and author's collection.

The paratypes vary in size, from 18 to 14 mm. with wing lengths of 16 to 12 mm. Those from Colombia are a little dusty and slightly faded, those from Venezuela somewhat rubbed and several lack antennae. The species resembles piceiventris but has a narrower frons, longer antennal tooth, evenly tinted wings, bicolored fore tibiae and pale abdominal triangles. It differs from lineifrons Lutz in broader frons and lacking an appendix on fork of third vein, and from lutzi Krob. in smaller size, black antennae and bicolored fore tibiae. The name is a MS name under which the 3 Colombian examples stood in the Lutz collection. These bear the numbers T-996, T-997 and T-998 and I will be deposited in Museu Goeldi with other Ducke material. It is eminently fitting that a Tabanus bear the name of the great naturalist who collected it and who supplied Lutz with most of his Amazonian material.

TABANUS FORTIS Fairchild (Fig. 28, Map 5)

Tabanus fortis Fairchild 1961, Studia Ent. 4(1-4):477, nom. nov. for T. robustus Kröber 1929.

Tabanus robustus Kröber 1929, Ann. Naturh. Mus. Wien, 43:254, fig. 12, female, Taperinha, 45 km. E.S.E. of Santarem, Pará, Brasil. Fairchild 1966, Studia Ent. 9(1-4):374-375, type seen.

Kröber's figure is somewhat exaggerated, the antenna of the type having a shorter dorsal tooth and less pronounced ventral angle than he shows. The species is a uniform dark brown all over, clothed with black and dark reddish pilosity. The tibiae are slightly paler than femora, partly due to paler pilosity. The antennae are orange to dark reddish, the style rarely dusky. Halteres with contrasting ivory white knob. Wings evenly smoky brown, no appendix and first posterior cell wide open. The species was quite abundant at Fazenda Morelandia, Mun. Benevides near Belém, Pará, Brasil, where large numbers were attracted to a horse in heavy forest for a short time near dusk. My colleagues and I also took specimens at Reserva Ducke near Manaus and at the Campina Research Station north of Manaus in flight traps in heavy forest. I have also studied specimens from Amapá, Brasil and from Surinam, Coppename river; British Guiana, Kartabo; and Guyane, Surcouf coll. One of the Kartabo specimens was determined by Kröber as Stigmatophthalmus sp. in 1925. Specimens bear dates from May to October. What I believe is the male is represented by a damaged specimen from Kartabo, B. G. lacking most of abdomen. Tinctorially it is like the female. The eyes are holoptic, with a poorly demarcated area of slightly enlarged facets occupying about 1/3 eye area and with a small tubercle sunk between the eyes at vertex.

TABANUS FUSCUS Wiedemann (Figs. 9, A, B, Map 9)

Tabanus fuscus 1819, Zool. Mag. 1(3):41, female, Brasil; 1821, Dipt. Exot. 1:68; 1828, Auss. Zweifl. Ins. 1:121, 556. Coscarón 1979, Obra Cent. Mus. La Plata, 6:263, fig. 3, L to O. Fairchild 1967, Pacific Ins. 9(1):97-98.

Chelotabanus fuscus: Kröber 1932, Rev. Ent. 2(3):294-295.

Tabanus piceus Thunberg 1827, Nova Acta Uppsala 9:55, female, Brasil.

Philip 1967, Ann. Ent. Soc. Amer. 60(6):1235-1236, synonymy.

Tabanus bicolor Thunberg 1827, Nova Acta Uppsala 9:55, female, Brasil.

Philip, 1967. op. cit. 60(6):1236, lectotype, synonymy (not T. bicolor Wied. 1821).

Tabanus impressus Wiedemann 1828, Auss. Zweifl. Ins. 1:126-127, female,

Montevideo. Philip 1967, Ann. Ent. Soc. Amer. 60(6):1236. Fairchild 1967, Pac. Ins. 9(1):99.

Tabanus monochroma Wiedemann, 1828, op. cit. 1:555-556, female,

Montevideo. Fairchild 1967, Pac. Ins. 9(1):100, synonymy, lectotype.

Tabanus clausus Macquart 1848, Dipt. Exot. Suppl. 2:17 (1847:33), female,

Brasil. Kröber, 1934, Rev. Ent. 4(2):261, synonymy. Fairchild, 1956, Smithsonian Misc. Coll. 131(3):13.

Tabanus ferreus Walker 1848, List. Dipt. Ins. B.M. 1:150, male (actually

female), Brasil. Fairchild 1956, Smiths. Miscell. Coll. 131(1): 16.

Philip 1967, Ann. Ent. Soc. Amer. 60(6):1236, synonymy.

Chelotabanus ferreus: Kröber 1932, Rev. Ent. 2(3):299, type female London redescribed.

Tabanus erythraeus Bigot 1892, Mem. Soc. Zool. France, 5:687, female,

La Plata. Kröber 1934, Rev. Ent. 4(3):311, syn. of monochroma

Wied. Not Atylotus erythraeus Big. 1892 p. 661 Mexico. Fairchild

1956, Smiths. Misc. Coll., 131(3):15, syn. of impressus Wied.

There seem to be 2 closely similar taxa here, differing very little in structure in the female, but if my association of sexes is correct, clearly in the males. The above synonymy all refers to one species, so far as can be made out from study of the original descriptions and comments of authors, including my own notes on types. This species has an entirely black third antennal segment, when unfaded by age, with a long forward pointing dorsal tooth, dark brown to black and black haired thorax and abdomen, dark brown beard, black unicolorous legs, and the abdomen with small sparsely white pilose spots dorsolaterally on tergites 4-6 and with a pair of similarly white pilose stripes or rows of connected triangles ventrally. The wings are quite strongly tinted, especially the costal and basal cells and the first posterior cell is nearly always closed and petiolate, rarely narrowly open. The 3 males I have seen from Sta. Catarina are entirely very dark brown, black pilose, but with abdomens slightly bluish pruinose. There are no white hairs anywhere on their bodies, the wings are rather evenly yellowish tinted and first posterior cell is narrowly open in 5 wings, closed at margin in one. The eyes are bare, holoptic, but without discernable enlarged facets.

The other taxon I have so far been unable to match with any descriptions. It appears to have been included in several accounts as a variant of fuscus, but it is odd that none of the above listed synonyms agree with it. It differs from fuscus in being paler and browner overall, the wings more evenly and palely yellowish fumose, the antennae browner with a slightly

shorter dorsal tooth and the abdomen brown, black haired, and with traces of middorsal yellow hair patches on tergites 1 to 3, laterally on 1 to 4 and ventrally in the form of sublateral broad stripes. The male has a well defined area of enlarged facets about 1/2 total eye area, brown slender antennae and vestiges of ventral yellowish pilose stripes on the abdomen. The palpi of the males of the 2 forms differ as figured (fig. 9). The wings of the females have the cell closed in 7 of the 8 available wings, narrowly open in 1. In the male the first posterior cell is very slightly narrowed. I refrain from naming this entity, if such it is, pending receipt of further and fresher confirmatory material. Of fuscus, I have before me the following material, all from Brasil. Three males, Nova Teutonia, Sta. Catarina, Jan. 1960, Plaumann; 4 females, S. Paulo. Boraceia Field Station, Jan., Feb., Mar. 1975, T. E. Rogers; 1 female, Rio de Janeiro, Oct. 1937; 1 female, Rio Tamandua, Ribeirão Preto, S. Paulo, 28-X-54, Barretto coll.; 1 female, Paraná, Prainha 22-I-49; 1 female, Ilhéus, Bahia 18-VIII-1935. Of the other taxon, I have 1 male, Butantan, S. Paulo, 22-I-1918, A. Esteves; 1 female, Rio de Janeiro Oct. 1937; 1 female, Boraceia, São Paulo, 1-4 Mar. 1975, T. E. Rogers; 2 females, Sta. Catarina, Brusque and Florianopolis XII-1957, J. Lane. The two forms thus appear to be largely sympatric, but are shown by different symbols on Map 9. Coscarón figures female and genitalia; says male unknown.

TABANUS GLAUCUS Wiedemann (Fig. 20, Map 4)

Tabanus glaucus Wiedemann 1819, Zool. Mag. 3:43, female, Brasil; 1821, Dipt. Exot 1:69. Fairchild 1967, Pacific Ins. 9(1):98, synonymy, lectotype designation; 1971, Cat. Dipt. Amer. S. of U.S. 28:94.

Tabanus cinerarius Wiedemann 1828, Auss. Zweifl. Ins. 1:121-122. Lutz 1928, Est. Zool. Parasit. Venezolanas, Rio de Janeiro, 58, Pl. 9, fig. 9. Kröber 1931, Zool. Anz. 96:59-61, figs. 8, 9. (Gymnochela).

Tabanus tenens Walker 1850, Newman's Zool. 8, Appendix 1, p. LXV, female, Para. (Not tenens Walker 1850, Insect. Saunders., Dipt. 1:49).

Tabanus confligens Walker 1854, List. Dipt. Ins. B.M. 5, suppl. 1:213, 326, n.n. for tenens Wlk.

Tabanus (Straba) grandis Kröber 1931, Zool. Anz. 94(3-4):68, fig. 1, male, Bolivia, Prov. Sara. Fairchild 1966, Stud. Ent. 9(1-4):371-372, synonymy. (Not Tabanus grandis Szilady 1923).

The species is very similar to T. nebulosus but is darker, the palpi largely or wholly black pilose, the integument of mesonotum and scutellum black, the femora usually black or at least darker than tibiae, a strong blackish integumental triangle or streak nearly always present on first 2 tergites, small median yellowish pilose triangles usually present on most tergites as well as rounded yellow to orange pilose dorsolateral spots, and the wings never with the faint cloud usually present on the fork of third vein in nebulosus. In addition, the frons of glaucus is usually parallel sided or more often slightly narrower at vertex, a condition seen but once in nebulosus. Further discussion will be found under nebulosus.

Specimens are at hand from the Brazilian states of Pará, Mato Grosso, São Paulo and Rondonia, and from Bolivia, eastern Peru, eastern Colombia

and Trinidad. It appears to be active in most months of the year. I have specimens compared and agreeing with both Wiedemann's and Walker's types.

TABANUS GUYANENSIS Macquart (Fig. 18, Map 1)

Tabanus guyanensis Macquart 1845, Dipt. Exot. suppl. 1:169(1846:41) Tab. 4, fig. 3, female, Guyane. Fairchild 1956, Smiths. Misc. Coll. 131(3):18, synonymy; 1961, Stud. Ent. 4(1-4):447, Amapá, Brasil; 1971, Cat. Dipt. Amer. S. of U.S. 28:94.

Tabanus flavibarbis Macquart 1845, Dipt. Exot. suppl. 1:169, female, Cayenne. Bequaert 1926, in Med. Rep. Hamilton Rice Seventh Exped. Amazon, etc., Chap. XV, Insecta, p. 231. Kröber 1929, Ann. Naturhist. Mus. Wien, 43:251-252, fig. 3, female, male, Taperinha 45 km. E.S.E. of Santarém, Pará, Brasil.

Atylotus rubrinotatus Bigot 1892, Mem. Soc. Zool. France 5:676, female, unknown locality. Fairchild 1956, Smiths. Miscell. Coll. 131(3):27, synonymy.

This large brown species is characterized by the brown bases of the wings with strongly infuscated calypters, gray striped mesonotum with usually strong tufts of white hairs on each side of scutellum, abdomen with large contiguous gray median triangles on tergites 2 to 4 and less distinct gray dorsolateral stripes on tergites 2 to 6. Kroeber (1929 c.) has described and figured the male. Material before me is mostly not well preserved, but is from the following localities. Brasil, Pará, Marajó Id., 1 female; Aurá, 1 female; Ilha das Onças, 1 female; Educandos, 1 female; Belém, 2 females; French Guiana, Cayenne, 1 male; Ecuador, Napo, Limoncocha, 1 female; Nueva Rocafuerte, 1 female; Peru, Madre de Dios, Tambopata Res. 7 females; vic. Pucallpa, 1 female; Bolivia, Riberalta, 1 female; Colombia, Amazonas, 60 km. NW Leticia, I-VI-79, 2 females.

The use of guyanensis rather than flavibarbis for this species is explained in the following excerpts from my notes on the specimens in the British Museum made in 1953.

Six females in B.M. There are four specimens labelled as Types, an additional specimen from the Bigot coll. bears a Macquart hand written identification label, and a sixth specimen bears an Austen hand "comp. with Type" label. These specimens represent between them three distinct species of which none of those presently labelled as Types agree with the original description. The two additional specimens not labelled as Types do agree with Macquart's description. Taking the specimens one by one we have the following: Specimen a. Bears a red circled Type label, a hand written Macquart label reading "Tabanus guyanensis n. sp." pasted onto a Bigot label reading "Guyanensis Macq. D. Exot.", a Bigot coll. B.M. accession label, a Kröber det. label reading "Tabanus? aff. innotescens Wlk.", and a note by Philip stating "Not Guyanensis Macq.". Specimen b bears a yellow circled Paratype label, a Bigot coll. B.M. accession label, a det. label in Barnes' hand, a Kröber det. label reading: "Tabanus? Guyanensis" and a red Lectotype label reading "Tabanus Guyanensis" placed upon it by Philip. This specimen appears to have had the head glued on at one time. It is not innotescens Wlk. nor is it guyanensis in my opinion, since the abdomen is entirely clothed with reddish hair and the antennae are reddish brown. Specimen c bears a yellow Paratype label, a Bigot coll. accession label, a

det. label in Barnes' handwriting (Barnes was Austen's technician), and a Kröber det. label reading "Tabanus? Guyanensis". This specimen is innotescens Wlk., the same as specimen a. Specimen d bears a yellow Paratype label, Bigot coll. accession label, and a Kröber det. label reading "Tabanus flavibarbis Macq. - Verblichen." This specimen, as noted by Kröber, is faded and dirty, but traces of small pale-haired middorsal triangles remain on the yellowish brown abdomen. It is not innotescens nor is it the same as the specimen labelled Lectotype by Philip in my opinion. Specimen e bears no Type label, but a Bigot coll. accession label with "Brazil", a Macquart hand written label with "Tabanus guyanensis female J. Macq." pasted onto a Bigot label reading "male coll. Serville Brazil D. Exot." It is a different species from those previously listed and in many ways agrees much better with the original description. Specimen f bears a black circled label, a hand written label reading "Tabanus guyanensis Macq. compared with Type", and a Kröber det. label reading "Tabanus guyanensis = flavibarbis Macq." This specimen agrees perfectly with specimen e.

I have gone over this puzzling situation with Mr. Oldroyd. He says that the Bigot material arrived at the B.M. without labels except those of Bigot, i.e. the Macquart hand labels pasted onto the Bigot labels. Austen went over some of them and the labels in Barnes' handwriting (specimens b and c) represent Austen's opinion, as Barnes was his technician at that time. The specimens were double mounted to fit the shallow B.M. drawers after they were received, necessitating the removal and replacement of all labels, and the B.M. accession labels added. Type labels circled in color were added much later by Oldroyd. Oldroyd thinks it likely that the five specimens (a to e) now bearing Bigot coll. accession labels had between them only the two original Macquart labels now on specimens a and e. When they were remounted on receipt at the B.M. from Verrall, it is probable that the technician, assuming that all were one species, was not too careful in returning the two labels to the exact specimens on which they were before. The specimen labelled as "comp. with Type" may have been compared by Austen when the Bigot collection was still in Verrall's hands. It certainly would not have been so labelled had one of the presently labelled types been the basis for comparison, since none of these agree. The Bigot specimen (e) bearing no type label does agree however, and is also the only one of the Bigot series which agrees at all with the original description. I have placed a note to this effect on specimen e, and consider that it should be designated as Lectotype. I believe the label on specimen a above really belongs on specimen e. My specimen from Pará, as well as others from Eastern Ecuador, agree with this last specimen e.

I was unable to locate the type of T. flavibarbis Macq. either in the B.M. or in Mus. Paris. It was described from the collection of Marquis Spinola, from Cayenne. Kröber (1934) claims to have seen the type, and makes (1930) guyanensis a synonym. What Kröber (1929, 1930) and Bequaert (1926) treat as flavibarbis is the same as the specimen I consider the type of guyanensis. Guyanensis precedes flavibarbis on the same page of Macquart's work, and since a type exists, I believe should be accorded priority. The descriptions of the two species do not seem to differ in any important respects, and in the absence of authentic material of flavibarbis, I believe it should be considered a synonym of guyanensis. Flavibarbis was selected as the subgenotype of Lophotabanus Szilady by Borgmeier (1933) on the advice of Kröber, but not only is the species not a Lophotabanus, it was not

included by Szilady (1926) in his original proposal of the subgenus, as pointed out by Bequaert (1940) when he substituted T. bifloccus Szil. (= bifloccus Hine) as subgenotype.

To summarize, I believe that specimens a and c are innotescens Walker, and specimens e and f are guyanensis Macq. Specimen b I do not recognize. Specimen d, although not the same species as guyanensis is close, and may have been confused with it by Macquart. It seems probable that it may have borne the label now on specimen e, which indicates a subsequent det. by Macquart of a specimen from Brasil.

TABANUS HUMBOLDTI n. sp. (Fig. 27, Map 6)

An inconspicuous moderate sized species with blackish thorax, brown abdomen with a row of small faint middorsal dull yellow triangles, bicolored fore tibiae, yellow antennae, narrow frons and glass-clear wings.

Female. Length 16 mm., of wing 13.5 mm. Eyes bare, color or pattern not recorded. Head structures as figured. Frons yellowish gray pollinose, darker and partly bare at vertex, with a black bristled occipital fringe and short brassy hairs on vertex behind. Callus black, dark brown basally. Subcallus, frontoclypeus and genae silvery gray pollinose, whiter than subcallus, both with long sparse white hairs. Beard dense, white. Antennae orange yellow, scape and pedicel with short black setae dorsally, longer whitish ones on sides and below. Third segment with plate orange, style blackish brown. Palpi yellowish white, the basal segment white pilose, the terminal black pilose apically, white basally and ventrally. Proboscis less than head height, dark brown, membranous.

Mesonotum and scutellum with blackish integument, the notopleural and pronotal lobes and sides of scutellum paler, yellowish. Pleura and coxae with more or less blackish integument. Mesonotum gray pollinose, beset with erect black and recumbent brassy hairs, the latter quite dense. Notopleural lobes mainly black pilose, pleura and coxae pale gray pollinose, abundantly white pilose. Fore coxae and femora blackish, the latter black pilose dorsally, long white pilose ventrally. Fore tibiae with basal half dull yellowish, yellow pilose, distal half dusky, black pilose as are tarsi. Mid and hind femora and tibiae reddish yellow, pale haired except for dark hind tibial fringes and all tarsi dark haired. Wings with venation normal, the first posterior cell slightly narrowed, membrane entirely clear including costal cell. Stigma pale yellow. Halteres with yellow stem and ivory knob.

Abdomen yellowish brown in ground color, dorsally black pilose except for small dull yellow median pilose triangles on tergites 1 to 6 and white hairs on extreme lateral margins of tergites 1 to 5. Beneath all sternites except the last are pale pollinose and white pilose.

Holotype female, Brazil, Mato Grosso, Rio Aripuana, Humboldt 59°27'W, 10°10'S, 12-16-VIII-1974, flight trap, D.G. Young coll. To be deposited in Museu Goeldi, Belém.

Paratypes. 8 females, same data as holotype. 1 female Rio Madeira, Abunã, Mann and Baker colls. 2 females, Amazonas, Manaus, Res. Ducke 5, 13-X-81, J. A. Rafael. Paratypes in I.N.P.A, F.S.C.A. and coll. of author.

The paratypes vary from 13 to 17.5 mm. with wing lengths of 10 to 14 mm. Hairs seem easily lost, and abraded specimens appear with plain brown abdomens and dark gray thoraces, since the abdominal triangles are not underlain by pale pollinosity. One paratype has a short appendix on third vein.

This species is quite similar to T. duckei, but has yellow antennae, narrower frons, and stouter palpi, among other differences. Its yellow antennae and lack of a pattern of black and white pilosity on venter of abdomen will distinguish it from small specimens of discus Wied. Named in honor of Alexander von Humboldt, after whom the type locality was also named.

TABANUS IMPORTUNUS Wiedemann (Map 1)

Tabanus importunus Wiedemann 1828, Auss. Zweifl. Ins. 1:127, female, Brasil. Fairchild 1943, Ann. Ent. Soc. Amer. 35(4):444, Pl. 1, fig. 2; 1967, Pac. Ins. 9(1):99 synonymy; 1971, Cat. Dipt. Amer. S. of U.S. 28:95, synonymy, distrib.

There seems no need to repeat the synonymy, which is detailed in the Catalogue. I have seen the types of all the names there listed. The species, like many common and widespread forms, is quite variable, but can usually be recognized by a combination of gray pollinose mesonotum, smoky areas at ends of basal cells, below stigma, and at fork of third vein, orange brown abdomen with large contiguous dorsolateral orange haired patches on terga 1 to 5, black haired middorsal stripe without pale triangles, and very short stout palpi. The male is very similar in appearance, the eyes bare, holoptic with a well demarcated area of large facets occupying about 1/2 eye area. Importunus is a species of open country and disturbed habitats and may be an important pest species. It ranges from Panama south to Paraguay, Bolivia and N. Argentina east of the Andes, but was not taken by Wilkerson (1979) in western Colombia. Badly denuded specimens of this and T. nebulosus are sometimes difficult to distinguish. Importunus has shorter and more inflated palpi and a dark shade below wing stigma, lacking in nebulosus.

TABANUS INDECISUS (Bigot) (Fig. 21, Map 5)

Atylotus indecisus Bigot 1892, Mem. Soc. Zool. France 5:666, female, Amazonia. Fairchild 1956, Smiths. Miscell. Coll., 131(3):20 synonymy. Tabanus indecisus: Kröber 1934, Rev. Ent. 4(3):310. Atylotus simplex Bigot 1892, Mem. Soc. Zool. France 5:667, 3 females, Amazonia, Cayenne. Fairchild 1956, Smiths. Miscell. Coll. 131(3):29, lectotype designation; synonymy. Not Tabanus simplex Walker 1850.

Only the lectotype in B.M. from the Amazon is this species. I have long series from the vicinity of Belém, Pará, from Humboldt, Rio Aripuana, Mato Grosso, and 1 female each from Porto Velho, Rio Madeira and Peixe Boi, Pará. The species is yellowish brown, the wings lightly and rather evenly faintly brown tinted, the abdomen with prominent yellowish pilose mid-dorsal triangles on tergites 1 to 4, fainter and smaller triangles on 5, and weak, broken pale dorsolateral stripes on tergites 1 to 6, often difficult to see or absent in rubbed specimens. Third antennal segment is black and the frontal callus is round or oval, not an evenly tapered claviform ridge. The abdomen beneath is wholly yellowish pilose, and the prescutellar dark spot is faint and poorly developed.

TABANUS ITAITUBA n. sp. (Fig. 25, A, Map 6)

A large brown species with light brown wings, body and legs entirely clothed with orange yellow pilosity and light brown pollinosity.

Female. Length 20 mm., of wing 16 mm. Eyes bare, the color and pattern in life not recorded. Head structures as figured. Frons dark yellowish brown pollinose, the callus yellow, subcallus with integument orange, gray pollinose. Frontoclypeus and genae the same, beard pale yellowish. Occipital fringe rudimentary, of scattered short dark bristles. Antennae orange, the scape, pedicel and dorsal tooth of basal plate densely dark bristled, the annulate portion of third segment blackish, contrasting with plate. Palpi orange, largely black pilose except ventrally where hairs are longer and yellow. Proboscis less than head height, blackish, wholly membranous.

Mesonotum and scutellum reddish brown, thinly gray pollinose, the pilosity largely of recumbent shiny golden hairs with scattered erect black bristles. Pleura and coxae concolorous. Legs, except blackish tarsi, wholly reddish brown, entirely golden pilose, without hind tibial fringes. Wings with normal venation, no appendix on third vein, wholly pale brownish, the color stronger along the veins. Stigma yellow. Halteres with orange stem, yellowish knob. Abdomen pale orange brown, wholly orange pollinose and dark golden pilose, both above and below.

Holotype female, Brasil, Pará, Jacarecanga, X-1959, M. Alvarenga leg. To be deposited in Museu Paraense Emilio Goeldi, Belém, Pará.

Paratypes, 3 females same data as holotype. 1 female, Transamazonica, Itaituba - Altamira Km 25, Dec. 1971, K.D.W. coll. 1 female, Brasil, Pará, Itaituba, Parque Nacional Amazonia, 17-XI-78, W.L. Overal coll.

The paratypes vary in size from 18 to 22 mm., wing lengths 16.5 to 18.5 mm. and somewhat in color, the Itaituba specimens being darker with dark reddish rather than golden pilosity, perhaps because less faded with time.

The wholly rufous to golden pilosity will easily distinguish this species from all other described regional species except chalcothrix Fchld. and corpulentus Brèthes. Chalcothrix differs by having long slender antennae and a very long appendix at fork of third vein, while corpulentus is a larger species with shorter antennal tooth and wings basally brownish, apically hyaline.

TABANUS LUTZI Kröber (Fig. 16, Map 5)

Tabanus macquarti Kröber 1930, Zool. Anz. 90(3-4):83-84. Type female in Vienna (not T. macquarti Schiner 1868).

Tabanus (Lophotabanus) lutzi Kröber 1934, Rev. Ent. 4(3):296 (nom. nov. for macquarti Kröb.).

For some reason I overlooked this species when treating the species described by Kröber (Fairchild 1966). I saw the type in Vienna in 1964, which was labelled as follows: old handwritten Venezuela; printed Alte Sammlung with columbensis written in; pink type; Kröber det. label 1929 as Tabanus macquarti. A compared specimen from Sevilla, Magdalena, Colombia agreed well with the type except for darker legs.

This is an overall yellowish brown species, the integument of thorax reddish brown, scutellum reddish, both with yellowish gray pollinosity and mainly yellowish pilose. There is a small patch of short black pilosity at junction of scutellum and mesonotum, with a small tuft of pale hairs on each side, probably the reason Kröber placed the species in (Lophotabanus). The wings are clear, slightly brownish tinged in basal and costal cells, venation normal, no narrowing of first posterior cell nor appendix at fork. The legs are black and black pilose except for pale hairs on posterior aspect of mid and hind femora. Halteres with brown stem and yellow knob. Abdomen reddish brown in ground color, lighter than thorax, pollinose, the first 4 tergites clothed with yellow hair except for a widening broad longitudinal stripe of black pilosity beginning on second tergite and broadening to cover all the tergites beyond the 4th. Beneath, the sternites are yellow pilose at sides and posterior margins, but with the centers of all segments beyond the 1st with increasing black hair until the 7th, which is wholly black haired. Palpi are yellowish, largely black pilose. Structurally this species is much like T. olivaceiventris, T. guyanensis and T. nebulosus, but abundantly distinct on color characters. The male is still unknown.

The species seems to have a restricted distribution in extreme north-western S. America, as my few specimens have come from Sevilla, Magdalena, Colombia, 21-VII-1927, Geo. Salt coll., 1 female; Venezuela, Apuré, Guasdalito, June 1924, Grisoll coll., 3 females; Venezuela, Apuré, Palmarito 15-VIII-1954, I. Ortiz coll., 1 female; Venezuela, Yaracuy, Farrias, 2-VIII-54, I. Ortiz coll., 1 female.

TABANUS NEBULOSUS DeGeer (Map 3)

Tabanus nebulosus DeGeer 1776, Mem. Serv. l'Hist. Ins. 6:227, pl. 30, fig. 2, female, Surinam. Philip 1952, Ann. Ent. Soc. Amer. 45(2): 312, synonymy; 1969, Acta. Zool. Lilloana, 22:128-129. Coscarón 1979, Obra Cent. Mus. LaPlata, 6:266-267, figs. 4F to 4T.

Tabanus ferriifer Walker 1850, Ins. Saunders., Dipt. 1:30, female, Barbadoes. Fairchild 1942, Ann. Ent. Soc. Amer., 35(4):444, fig. 3, synonymy.

Coscarón (1979) has figured both sexes in detail, and given a full list of references while Fairchild (1971) has updated the synonymy, which it seems unnecessary to repeat here. There is a good deal of variation, seemingly correlated with geography. This I recognized in 1971 by accepting ornativentris Kröber in a sub-specific sense for the dark heavily marked specimens from the southern part of the species' range. This is the form illustrated by Coscarón (l.c.). Specimens from as far north as Belize and Nicaragua to Surinam and Venezuela are pale brown with large pale orange pilose dorsolateral abdominal spots, pale femora concolorous with tibiae and wings with hardly discernible clouds at fork and crossveins. Specimens from the Amazon basin, Belém and Humboldt, Mato Grosso, are darker overall with femora more or less dusky, but wings even less spotted. Material from Paraguay (5 localities) and Argentina (Santa Fé) has very heavily spotted wings, generally black femora and male eyes with a larger area of enlarged facets, as noted by Philip (l.c. 1969). These differences are as great or greater than those used to separate T. glaucus from nebulosus, but unfortunately a single female from Dept. Beni, Bolivia, is quite pale,

with yellowish femora and wing spots quite weak, though larger than in any northern specimen seen. It also agreed well with a 'cotype' of ornativentris in B.M., though much paler than a Paraguayan specimen compared and agreeing with the holotype in Stuttgart. More material from critical areas is needed for a final determination of the status of ornativentris.

In the Catalogue (Fairchild 1971) I placed nubeculipennis Kröber from Venezuela as a synonym of nebulosus after study of its type in Vienna. I now believe that it is more probably a synonym of glaucus, since Kröber notes that the frons is narrowed above, a relatively rare condition in Tabanus, but found in 6 of the 11 examples of glaucus I measured, though not in any specimens of nebulosus measured.

It is sometimes difficult to place specimens in this group, as variation is considerable. Importunus usually has shorter and more inflated palpi, wings more heavily infuscated, especially below stigma, clear or very pale yellow costal cell, no median pale abdominal triangles, parallel or slightly divergent frons, and reddish scutellum. Nebulosus has longer and slightly less inflated palpi, paler wings with seldom any infuscation below stigma, clear or more often pale yellow costal cell, median pale abdominal triangles present in northern specimens, often absent in those from south of the Amazon river, parallel or slightly divergent frons and usually dark reddish scutellum. Femora of both importunus and nebulosus are usually yellow to orange, but specimens with fore femora dusky to black are not uncommon and some very dark specimens from Belem have all femora quite dusky basally. Glaucus has longer and more slender palpi, wings evenly tinted but costal cell dark yellow to orange and often the basal cells more or less infuscated. Median abdominal pale pilose triangles often forming a slender stripe and usually a slender black integumental streak on first 2 tergites. Frons nearly always appearing narrowed above, so that divergence index is rarely over 1.00. Scutellum usually black, rarely reddish. Femora usually entirely blackish, but in a few specimens only basally dusky or wholly orange. Ornativentris is structurally like nebulosus, but has heavily spotted wings, infuscated femora, and the dorsolateral abdominal pale patches are reduced to small oblique spots.

Frontal measurements of the available specimens give the following maxima, minima and means of the frontal and divergence indices.

T. glaucus, 11 specimens, 5.8-4.7, mean 5.12 and 1.05-.85, mean .96;

T. nebulosus, 11 specimens, 5.78-4.77, mean 5.27 and 1.40-1.14, mean

1.25; T. nebulosus ornativentris 6 specimens, 5.33-4.62, mean 5.01, and 1.66-1.31, mean 1.41.

TABANUS NEBULOSUS ORNATIVENTRIS Kröber (Map 3)

Hybostraba ornativentris Kröber 1929. Konowia 8:182, pl. 2, figs. 10, 11.

Fairchild 1966, Studia Ent. 9(1-4):363.

In 1966 (l.c.) I discussed the involved synonymy of this name and concluded it was best treated as a southern subspecies of nebulosus DeG., as it appears in the catalogue. The frontal indices of available specimens do not differ appreciably from those of nebulosus. The accompanying map indicates that the 2 forms are allopatric, though much further collecting will be needed to more clearly define their ranges. See also the discussion under T. nebulosus.

TABANUS NEMATOCALLUS n. sp. (Fig. 11, Map 11)

A black species with very narrow frons, brown tinted wings, black antennae, white beard, and usually closed 1st posterior cell.

Female. Length 18 mm., of wing 16.5 mm. Eyes bare, in life greenish black, unpatterned. Head structures as figured. Frons black in ground color, gray pollinose, the upper half thickly beset with short black proclinate setae and a small bare spot at vertex. A postoccipital fringe of stiff black setae mixed with longer lax silver hairs. Subcallus, frontoclypeus and genae silvery white pollinose and with long white hairs. Antennae entirely black, the scape gray pollinose, it and pedicel with black setae dorsally, white ventrally. Palpi with long silvery hairs on first segment and base of second, the terminal half or more of second segment with short black setae. First segment dark gray in ground color, white pollinose. Second segment yellowish white in ground color, whitish pollinose. Proboscis blackish brown, fleshy, the stylets slightly longer than palpi, less than 1/2 head height.

Integument of mesonotum blackish, the notopleural lobes, sutures and extreme sides reddish, dark gray pollinose, clothed with reclinate and erect short black setae and recumbent coppery hairs, the latter forming indistinct dorsolateral stripes covering ends of transverse sutures and sides of scutellum. Prescutellar black spot faint, weakly defined laterally by small paler hair tufts. Pleura black, dark gray pollinose, white pilose except for a tuft of black hairs on mesopleuron. Coxae black, gray pollinose, largely white pilose. Femora black, gray pollinose, dorsally black pilose, ventrally white haired. Tibiae dark brown, wholly black pilose, as are tarsi. Wings strongly brownish, the color filling basal and costal cells, elsewhere in the form of broad margins to all veins. No appendix at fork of third vein, but first posterior cell closed at margin in one wing, barely open in the other. Halteres with orange stem, yellowish white knob. Calypters dusky, the lower lobe with a tuft of silver hairs.

Abdomen with integument nearly black dorsally, bluish black pruinose, black-haired except for very small median white hair tufts on posterior margins of tergites 1 to 6 and larger nearly circular white hair patches dorso-laterally on tergites 2 to 5. Sides of tergites 1 to 4 have contrastingly white integument and white pollinosity and pilosity. Beneath sternite 1 is yellowish in ground color, the remaining sternites dusky with paler margins. Vestiture of sternite 1 is white, the remainder have black hairs in the middle and at the sides, with posterior marginal white pilose bands and a ventro-lateral white stripe the length of abdomen on each side.

Holotype female, Brasil, AM, Manaus, R. Ducke, 20-X-68, R. L. Dressler coll. To be deposited in I.N.P.A.

Paratypes 15 females, Brasil, Amazonas, Manaus, Reserva Ducke, VII-VIII-1981, flight trap, G. B. Fairchild coll., 2 females; Amazonas, Campina Research Sta., 60 Km. N. of Manaus 5-8-VIII-81, G. B. Fairchild coll., 1 female; Manaus, Colonia Sta. Antonio 10-VII-70, T. Pimentel coll., 1 female; Venezuela, Bolivar, Rio Chicarra, 27-IX-66, R. L. Dressler coll., 1 female; Peru, Putumayo, E. Encanto 25-VIII-20, Cornell Univ. Exped., 2 females; Iquitos, III-IV-1931, R. C. Shannon and 24-26-VI-74, J. E. Gillaspay coll., 37 females; Peru, Madre de Dios, Rio Tambopata Res., II-III-1982, Wilkerson coll., 3 females; Colombia, Amazonas, Leticia, II-1972, Ward and Forsyth colls., and 4-VI-79, on horse,

R. C. Wilkerson coll. Paratypes to be deposited in Canadian National Collection; coll. J. Burger; F.S.C.A.; Museu Goeldi, Belem; I.N.P.A., Manaus and the author.

The paratypes range from 16 to 21 mm. The median white spots on the abdomen are often reduced, absent or lost through abrasion, the wing coloring varies somewhat in intensity and the first posterior cell may be closed at margin, short petiolate, or narrowly open. The species can be separated from discifer by having less orange hair on mesonotum, paler wings without a dense and well marked black patch, entirely black antennae, white or gray pilose beard and pleura, entirely white pilose hind margins on all sternites, and closed or nearly closed first posterior cell. T. angustifrons differs principally in having glass clear wings with first posterior cell wide open and slightly less prominent dorsal antennal tooth. T. pellucidus has similar venation, but less heavily brown wings, brown abdomen and legs and usually larger white dorsal spots on abdomen.

I find it difficult to believe that such a seemingly abundant taxon has not heretofore acquired a name, but I have been unable to fit it to any description. The name provided refers to the thread-like frontal callus.

TABANUS OLIVACEIVENTRIS Macquart (Fig. 17, Map 8)

Tabanus olivaceiventris Macquart 1847, Dipt. Exot. Suppl. 2:34(18).

Fairchild 1971 Cat. Dipt. Amer. south of U.S. 28:98, synonymy.
Wilkerson 1979, Cespedesia 8(31-32):380-382.

The original description is very brief and the type is apparently lost, but the name has long been attached to a species common about Belem, Pará, Brasil and occurring elsewhere in northern South America. Fresh specimens are easily recognized by the combination of pale gray thorax with a black prescutellar spot, generally hyaline wings, and pale olive green abdomen. The eyes are glaucous greenish with a shifting pattern of darker spots. In well preserved specimens faint indications of 3 rows of paler pilose spots forming a median and a pair of dorsolateral stripes on the abdomen are sometimes apparent. The species is quite variable in size and wing color, some specimens having quite smoky wings. The abdominal vestiture may be all black, all yellow or with the stripes indicated above. The legs are entirely pale in ground color. The male is much paler, the abdomen being densely white pilose. The male eyes are not much enlarged, the area of enlarged facets being about 1/2 eye area, fairly well differentiated from the small facets but not very sharply demarcated. Specimens have been seen from Panama, Colombia, Venezuela, Guyane Francaise, Guyana, Suriname, the states of Pará and Amapá Brasil, and Trinidad. It is noteworthy that most records are from near coastal localities.

TABANUS PELLUCIDUS Fabricius (Fig. 10, Map 11)

Tabanus pellucidus Fabricius 1805, Syst. Antl., p. 97, female, Amer.

Merid. Wiedemann, 1821, Dipt. Exot. 1:70; 1828, Auss. Zweifl. Ins. 1:129. Kröber, 1934, Rev. Ent. 4(3):313. Fairchild 1966, Psyche 73(1):23-24, type seen.

Tabanus albibarbis Wiedemann 1824, Analect. Ent. p. 21; 1828, Auss.

Zweifl. Ins. 1:125-126, female, S. America. Fairchild 1967, Pacific Ins. 9(1):96, type seen.

Tabanus senior Walker 1850, Ins. Saunders. Dipt. 1:67, female, unknown locality.

Chelotabanus albibarbis: Kröber 1932, Rev. Ent. 2(3):297-298, Surinam, Br. Guiana.

Chelommia albibarbis: Philip 1960, Proc. Cal. Acad. Sci. 31(3):98.

Chelommia melanocnemis Barretto 1957, Rev. Brasil. Malar. 8(1):83-84 (1956). Female, Rio Negro, Amazonas, Brasil. ? in part.

This species differs from other members of the group by a combination of the following characters. Dark brown integument of both thorax and abdomen, the scutellum often apically reddish. White beard and white to grayish pleural pilosity; antennae black. Integument of legs including coxae brown. Integument of abdomen reddish brown, the anterior tergites sometimes semitranslucent. Abdomen bluish pruinose, black pilose, with both median and dorsolateral white pilose triangles and circular patches, the first often difficult to see in abraded specimens. Wings moderately brownish infuscated, accentuated along the veins. First posterior cell usually closed and petiolate, at most narrowly open. Beneath the abdomen is largely white pilose, but with a broad median black pilose stripe or row of connected spots. The prescutellar dark pilose spot is quite evident in most specimens.

I have studied, aside from the types of the names listed above, the following specimens. Guyana: Mallali, Br. Guiana, 4-31-07, 2 females, det. Hine as "Tabanus clausus Coq." and "Tabanus olivaceiventris Macq."; same locality, 5-15-07, 1 female, all three in Ohio State University. Venezuela, Estado Sucre, Guariquen 4-10-54, I. Ortiz coll., 1 female; Delta Amacuro, San Francisco de Guayo 27-XII-52, I. Ortiz coll. Suriname, Zanderij Id., 17-22-VI-64, 1 female and 18-21-VII-64, 2 females, D.C. Geijskes coll. Colombia, Meta, Carimagua, Tropical Dry Forest, 20-XI-74, some on cow, 10 females, R. Wilkerson coll. Peru, Madre de Dios, Rio Tambopata Reserve, 30 Km. SW Pto. Maldonado VII, X, XI-1982, 46 females, R. Wilkerson coll.

There is some confusion as to the identity of this species, perhaps due to Fabricius having 2 specimens before him. Wiedemann (1828, p. 129) redescribes the Fabrician specimen he studied as follows (free translation): "Feelers reddish yellow, second segment and tip of third brown. Beard deep yellow, lower face gray, frons yellowish with simple shiny ridge. The mesonotum with anterior part a little pale grayish, the pleura brownish haired. Abdomen dark ocher brown, venter paler. Wings a little smoky gray, the anterior veins brown margined. Legs dark ocher brown, the anterior nearly black." This contrasts with Fabricius' brief description which says (free translation): "Large. Head grayish hairy, antennae black. Thorax blackish, weakly reddish striped. Abdomen subtransparent, reddish, anus darkened. Wings whitish. Legs black." This does not disagree with the specimen I studied from the Copenhagen collection. The other specimen, from the Kiel collection, was so badly preserved that I could see little except that the wing had the first posterior cell open, not closed and petiolate. Such a careful worker as Wiedemann could hardly have drawn his description from the presently labelled Fabrician type. Kröber (1934) did not see specimens, or study the type.

The determination of the proper names for species in this group is most difficult. Either there are 1 or 2 very variable species ranging pretty much throughout the northern half of the continent, as I once believed, or a swarm of closely similar taxa separable on apparently trivial, though consistent, color characters, as now seems to be the case. Their large size and relative abundance in areas accessible to the early collectors resulted in the proposal of numerous names, as can be seen in the listings under pellucidus in the Catalogue (Fairchild 1971). My conviction that there was but one variable species arose partly through having very few specimens to compare with the types, and these in many cases in not much better condition than the often very incomplete types, so that I tended to ignore the small differences in my anxiety to have specimens compared and agreeing with the types. With the acquisition of reasonably good series of fresh material, it is evident that quite small differences may be important, and that many of my type comparisons of 1953 (Fairchild 1956) and 1964 (Fairchild 1966, 1967, 1967a, 1967b) are in need of revision. Since I cannot now re-examine all these type specimens, I am forced to make some possibly arbitrary decisions as to the names to be used for the various taxa recognized here. I hope that enough descriptive and illustrative information is included in the present review to enable the various forms to be recognized and my placements corrected by later students. This is especially true in the case of names placed in synonymy, where I have had to depend more on re-evaluation of the original descriptions rather than on what I or others have said or done previously.

Philip (1960) established the synonymy of senior with albibarbis after study of both types. Melanocnemis is placed on the basis of the description. It was described from specimens from upper Rio Negro, Amazonas (holotype) and British Guiana (Paratypes). I studied the latter and concluded they were the same as crassicornis, with open first posterior cell. Barretto does not mention the condition of the cell, but his description can apply equally well to pellucidus with closed or strongly coarctate cell.

TABANUS PICEIVENTRIS Rondani (Figs. 14, 15, Map 2)

Tabanus piceiventris Rondani 1848, Stud. Ent. Turin 1:106, female, Brasil.

Philip 1965, J. Med. Ent. 2(2):121. Fairchild 1971, Cat. S. A. Dipt., 28:99, synonymy.

Tabanus basivitta Walker 1850, Newman's Zoologist 8:68, female, Pará.

Fairchild 1956, Smiths. Miscell Coll. 131(3):12.

Tabanus bitinctus Walker 1857, Trans. Ent. Soc. London, NS 4(5):123, female, Pará.

Tabanus viduus Walker 1850 Newman's Zoologist. 8:68, female, Pará.

I have seen the types of all the above names. The species has not previously been figured. It is a nearly wholly dark brown species showing considerable variation in size and degree of infuscation. The eyes are greenish bronze in life, without stripes, but with a shifting pattern like watered silk. The antennae are dark brown to black, the slender palpi brown, black pilose, the face and cheeks grayish brown, the beard yellowish to nearly black. The mesonotum has blackish integument, thinly dark brown pollinose and with black and yellow brown hairs in a variable mixture. The scutellum may be concolorous or slightly lighter than mesonotum, but there

is always an obscure pair of pale pollinose spots anterior to a patch of black pollinosity between mesonotum and scutellum. These spots are usually more evident in denuded specimens, but are not evident in any of the males I have seen. The legs are dark brown, black haired, the femora, especially the fore pair generally slightly darker than tibiae. The fore tibiae are not bicolored, though they may be slightly paler basally. Wings without appendix but the first posterior cell slightly coarctate, more or less infuscated basally and anteriorly, often with anterior veins and fork with accentuated brown margins. In some areas the wings are nearly hyaline, only costal and basal cells showing some infuscation. Abdomen reddish brown to nearly black, brown pollinose, dorsally entirely black pilose, ventrally yellowish to orange pilose, as are the extreme lateral margins of at least tergites 1 to 5. Halteres with brown stem and yellow knob. The smallest specimen seen measured 12.5 mm. with wing of 11 mm., the largest was 20 mm. with wing of 17.5 mm.

Specimens from the vicinity of Manaus are exceptionally dark, with distal half of wings nearly hyaline, while specimens from the region around Belém are browner in body color but with more extensively infuscated wings. Specimens from Surinam, eastern Ecuador, Peru and Bolivia are like those from Belém. An occasional specimen shows a black integumental streak on tergites 1 and 2, like the type of basivitta Walk. I at one time felt that the Manaus population represented a distinct taxa, but except for paler wings, I cannot distinguish them from the presumably typical Pará specimens. A single female from Serra do Navio, Amapá, is like the Manaus material but is the specimen I compared and found to agree with Rondani's type in Naples.

A male from Belém, APEG forest (Mocambo) 29-VII to 6-VIII-1974, D.G. Young coll. has the upper eye facets well differentiated and demarcated from the small facets, in a patch occupying about 1/2 eye area, with a broad occipital band of small facets. There is a small tubercle sunk between the eyes at vertex. It differs from sympatric females only in having more slender antennae, a black beard and dark brown facial pollinosity, and having the abdominal venter entirely dark pilose. Another male from Fordlandia on Tio Tapajós, though old and faded, is like the one from Belém. Should males from Manaus prove conspicuously different, the status of that form will need to be reconsidered and the various type specimens recompared. Distribution of material seen by me is shown on the accompanying map. It was very abundant at the Rio Tambopata Reserve in E. Peru in Feb.-Mar. 1982, 387 females being taken in a flight trap.

T. piceiventris can generally be separated from similar regional species on the structure of head and appendages, dark slender antennae, unmarked dorsally dark pilose abdomen, orange or yellowish pilose beneath, normal venation, and vestiges of a prescutellar spot.

TABANUS PUNCTIPLEURA Hine (Map 4)

Tabanus punctipleura Hine 1920, Ohio J. Sci. 20(8):314-315, female, Costa Rica. Fairchild 1946, Ann. Ent. Soc. Amer. 39(4):569-570, Pl. 1, fig. 4.

Tabanus (Lophotabanus) defilippii: Kröber 1929, Zool. Anz. 83(1-4):126-127, fig. 8. Not T. defilippii Bellardi 1859, misdet.

One of the largest American species of Tabanus, reaching a body length of 23 mm. and wing length of 22 mm. It is an overall dark brown species with brown tinted wings, the costal cell yellowish brown, venation normal. Beard, facial and frontal pollinosity and pleural pilosity yellowish brown with a prominent tuft of black pilosity below wing bases. Antennae black, with a long dorsobasal spine on basal plate. Mesonotum dark brown, gray pollinose, dark pilose, with a prominent black pilose prescutellar spot bordered laterally with small tufts of bright yellowish white hairs. Scutellum concolorous or somewhat reddish. Legs very dark reddish brown, the femora slightly darker, mostly orange pilose but hind tibiae with a prominent posterior fringe of long black hairs. Abdomen black or nearly so, dorsally unmarked, bluish pruinose, the extreme posterolateral corners of tergites 1 to 4 with small pale yellow hair tufts. Venter as dorsum with occasional scattered pale hairs on hind margins of some sternites, but mainly black pilose. The eyes in life are light yellowish green, without bands.

All recorded specimens have come from a small area on the Atlantic or Caribbean coast of Costa Rica and adjoining Panama. The most similar species seems to be T. glaucus, with a similar frons and antennae, though there are numerous differences.

TABANUS SANNIO Fairchild (Map 7)

Tabanus sannio Fairchild 1956 Smiths. Miscell. Colls. 131(3):11-12, nom. nov.
 pro Tabanus austeni Kröber 1930. Not T. (Ochrops) austeni Szil. 1915.
Tabanus (Phaeotabanus) austeni Kröber 1930 Zool. Anz. 86(11-12):294,
 figs. 15, 15a, female, Amazonas.

A moderate sized species with wing lengths of 12-13 mm., the thorax with a broad white pollinose stripe its full length, covering all of scutellum. Legs dark brown, wholly black pilose except white pilose fore coxae. Hind tibiae with prominent hind marginal fringe. Abdomen blackish with white pilose median triangles on tergites 2 to 6, much larger on 2 and 4. Tergite 1 all white pilose and 2 to 6 white pilose laterally. Venter white pollinose and sparsely white pilose. Wings hyaline with a complicated pattern of blackish spots which consists of large patches in marginal and first submarginal cells beyond stigma and in apical half of anal cell and much of axillary cell, clouds at all cross veins and fork of third vein, and small spots in center of discal cell and in centers of all cells from 2nd submarginal to 5th posterior.

The type in B.M. is labelled "Amazon 66/53" and a paratype, now headless, is labelled "Amazon Ega 58/6" which may be what Kröber published as "Ago on the Rio" at the end of his description. His figure shows the frons too broad, index 4, while his description gives it as 5.5. His figure of the wing is not inaccurate, though the apical dark spot and that in the anal cell are more diffuse than the other dark spots. My measurements of frons of 3 specimens from Belém, Manaus and Madre de Dios, Peru, give frontal indices of 5.3, 5.2 and 4.9. The specimen from Belém and the 2 from Manaus were taken in traps set in the forest canopy, so the species, like xenorhynchus, is probably arboreal. My Brazilian specimens were taken in Aug. 1981, those from Peru in Nov. 1979, June and Oct. 1982.

TABANUS SUBVIOLACEUS Fairchild (Map 7)

Tabanus subviolaceus Fairchild 1961 Mem. Inst. Osw. Cruz, 59(3):291-293, fig. 5, female, S. Paulo. Brasil.

A blackish species with dark brown costal cells and slender dark brown antennae, but without conspicuous pale markings on thorax or abdomen. Only the types are so far known, the holotype and 1 paratype probably collected by Zikan in 1938, but without locality, the remaining paratype from somewhere in the state of São Paulo. It may prove to be no more than an extremely dark form of basilaris Kröb. when good series become available.

TABANUS UNIMACULA Kröber (Map 7)

Tabanus (Phaeotabanus) unimaculatus Kröber 1930, Zool. Anz. 86(11-12): 280-281, figs. 3, 3a, female, Surinam. Not Macquart 1834.

Tabanus (Phaeotabanus) unimacula Kröber 1934, Rev. Ent. 4(2-3):306 nom. nov. pro T. (Ph.) unimaculatus Kröber 1930.

? Philipotabanus (Mimotabanus) unimacula: Fairchild 1971, Cat. Dipt. S. Amer. 28:80; 1975, Ann. Ent. Soc. Amer. 68(4):689, not seen.

A moderately large species 16-18 mm. in body length, black with a white pilose and pollinose mesonotum and scutellum and a large white trapezoid on tergite 4. Legs entirely black, with long hind marginal fringes on hind tibiae. Wings hyaline with costal cell and most of wing proximal to stigma heavily infuscated. This black area is irregular posteriorly, not reaching hind margin, but with a spur along third vein to fork and paler areas in discal and second basal cells. The head structures are like those of other members of the xenorhynchus group with slender flattened palpi, long proboscis and slender black antennae.

Kröber's description (1930a) is fairly accurate, though his figures are not so good. The types were supposed to be in Halle, but were not received with other Kröber material kindly lent me by Dr. J. Husing previous to 1965. This led to my misplacing the species in 1971 and 1975. Loan of 2 near perfect specimens from Ecuador, Napo prov., Limoncocha, Rio Playaco, 23-VIII-1980, collected in a Malaise trap by Knopf and Dunkle, from my colleague Richard Wilkerson, has permitted proper placement of the species. These specimens agree very well with Kröber's description, though they differ somewhat from his figures. It is possible that examination of Surinam material may cause a revision of the status of these Ecuadorian specimens, though such a wide distribution is not unusual. The wing pattern is very similar to that of T. discifer, but the latter is a larger stouter insect with much narrower frons, small white dorsolateral spots on abdomen, and a prominent dorsal tooth or hook on basal plate of antenna. Subsequently my colleague, I. S. Gorayeb sent another specimen from Peixe Boi, Pará. It is now in Museu Goeldi, Belém.

TABANUS XENORHYNCHUS Fairchild (Map 7)

Tabanus xenorhynchus Fairchild 1947, Ann. Ent. Soc. Amer. (1946) 39(4): 572, pl. 1, figs. a, c. Female, male Panama. 1971, Cat. Dipt. S. Am. 28:104, Guatemala to Panama

A moderate sized species, 15-18 mm., dark brown to black, with a white margined scutellum and mesonotum, small median white spots on tergites 1, 2, 4, 5 and sometimes 6, much larger on 4, and white pilose patches on sides of tergites 1 to 3. Legs wholly black pilose, the hind tibiae with a posterior fringe of long black hairs. Wings smoky infuscated except for a hyaline patch which includes most of discal cell and basal halves of marginal, 1st submarginal and 1st posterior cells between ends of basal cells and fork of third vein. In addition, all cross veins and fork of third vein are surrounded by large round densely infuscated clouds.

The species has been taken frequently at light and in the forest canopy, but rarely at ground level.

TABANUS XUTHOPOGON n. sp. (Fig. 4, Map 12)

A narrow-fronted brown species with black antennae very similar to discus Wied. but with beard and pleural pilosity yellowish brown and with 3 rows of small yellow pilose spots on the abdomen.

Female. Length 18 mm., of wing 16 mm. Eyes bare, without pattern but the color in life not recorded. Frons yellowish brown pollinose beset with short black pilosity on upper half. Callus reddish brown. Vertex darker, subshiny. Occiput gray with long lax sparse pale hairs becoming shorter and darker and forming a fringe of bristles close to upper eye margin. Subcallus concolorous with frons. Frontoclypeus paler, yellowish gray, genae with yellowish gray pollinosity and yellowish brown beard. Antennae as figured, scape and pedicel dark reddish, densely black pilose, third segment velvety black or very dark brown. Palpi yellowish gray pollinose, pilosity largely black, but with brassy hairs basally and ventrally. Proboscis with membranous dull theca and labella, about 1/3 longer than palpi.

Mesonotum with dark reddish brown integument, grayish brown pollinose, the notopleural lobes and lateral margins paler. Pilosity of dark brown erect hairs and shiny orange recumbent hairs, vestiture of notopleural lobes long, blackish, erect, and tufts of longer yellow brown hairs just posterior to wing bases. A small patch of short dense black pilosity on pre-scutellum but scutellum concolorous with mesonotum. Wings with venation normal, first posterior cell a little narrowed distally. Veins light brown, costal cell yellow, membrane faintly brownish tinted along veins. Pleura yellowish gray pollinose, yellow to brown pilose, including coxae, and with a denser tuft of blackish erect pilosity below wing insertions. Legs black and black pilose except for orange pilosity on bases and posterior aspect of mid and hind femora. Halteres brown with pale yellow knob.

Abdomen with light orange brown integument, the first 2 tergites somewhat bluish pruinose. Dorsal surface black pilose except for small yellow pilose median tufts on terga 1 to 6, and small, round, faint pale pilose dorsolateral spots on terga 2 to 5. Extreme lateral margins of terga 1 to 4 with at least some pale yellow pilosity. Beneath the abdomen is subshiny, largely pale yellow pilose, but with black pilosity forming an indistinct broad median stripe and narrow lateral stripes.

Holotype female, Iquitos, Peru, Mar.-April 1931, R.C. Shannon. The specimen is in near perfect condition, only the tip of one wing worn. To be deposited in F.S.C.A.

Paratypes: Colombia, Amazonas, 9 km. N. Leticia, 3-VI-1979, on horse, R. Wilkerson coll., 1 female; Peru, Rio Samiris, 140 meters, 27-VIII-1952, G.O.P. leg. 1 female; Loreto, Callicebus Research Station, Mishana, Rio Nanay, 25 km. SW Iquitos, 120 m. elev., 10-17-I-1980, Tropical Wet Forest, J.B. Heppner, 3 females; Ecuador, Napo prov., Limoncocha vicinity, 22-7-VIII-1980, netted, Dunkle and Knopf, 2 females; same locality, Playaco river, malaise trap, 23-8-VIII-80, 1 female; Brasil, Pará, Urucurituba, 1 April. C.H.T. Townsend, 1 female; Pará, Rio Gurupi, Canindé, 9-IV-63, B. Malkin, 1 female. To be deposited in U.S.N.M., M.C.Z., Mus. Goeldi and collections of R. Wilkerson and the author. The name is from Greek, signifying a tawny or yellowish brown beard.

The paratypes vary a little, some having extreme bases of tibiae reddish, or lacking pale abdominal spots, which seem easily lost and, not being underlain by pale integument or pollinosity, are often not visible in rubbed specimens. The holotype and the paratype from Urucurituba were compared to Kröber's type of T. cervinus in 1964 and noted to be in fair agreement, but this was before the complexity of the group was appreciated. According to the original description, cervinus has white beard and whitish gray pleural hairs and white dorsal hair tufts on abdomen, thus agreeing with discus rather than the present taxon. Xuthopogon is very similar to discus, differing chiefly in the yellow to brown color of the pilosity and pollinosity of face and pleura, generally more brownish integument of thorax and usually more evident pale pollinose abdominal markings.

CHECK LIST OF SYNONYMS AND HOMONYMS

The following check list contains 53 names believed to be junior synonyms, or homonyms, of species discussed here. Full references to all will be found in Fairchild (1971). They are listed alphabetically here to save space rather than with their respective senior synonyms.

albibarbis Wied. 1824 = crassicornis Wied. 1821
 albidicollis Macq. 1850 = importunus Wied. 1828
 alboater Walk. 1850 = crassicornis Wied. 1821
 albomaculatus Walk. 1854 = discifer Walk. 1850
 albopruinosus Kröb. 1930 Not Szil. 1923 = amazonensis Barr. 1949
 atricornis Bigot 1892 = crassicornis Wied. 1821
 austeni Kröb. 1930 Not Szilady 1915 = sannio Fchld. 1956
 basivitta Walk. 1850 = piceiventris Rond. 1848
 bicolor Thunb. 1827 Not Wied. 1821 = fuscus Wied. 1819
 bitinctus Walk. 1857 = piceiventris Rond. 1848
 cervinus Kröb. 1929 = discus Wied. 1828
 cinerarius Wied. 1828 = glaucus Wied. 1819
 clausus Macq. 1847 = fuscus Wied. 1819
 communis Kröb. 1930 = discus Wied. 1828
 confligens Walk. 1854 = glaucus Wied. 1819
 coriarius Kröb. 1934 nom. nud. = olivaceiventris Macq. 1847
 druyvesteijni Szil. 1926 = nebulosus DeG. 1776
 erythraeus Bigot 1892 p. 687 Not Big. 1892 p. 661 = fuscus Wied. 1819
 ferreus Walk. 1848 = fuscus Wied. 1819

ferrifer Walk. 1850 = nebulosus DeG. 1776
 flavibarbis Macq. 1846 = guyanensis Macq. 1846
 grandis Kröb. 1931 Not Szil. 1923 = glaucus Wied. 1819
 guttigaster Kröb. 1934 = discifer Walk. 1850
 guttiventris Kröb. 1929 Not Enderlein 1925 = discifer Walk. 1850
 imponens Walk. 1857 = olivaceiventris Macq. 1847
 impressus Wied. 1828 = fuscus Wied. 1819
 incertus Macq. 1838 = nebulosus DeG. 1776
 infuscatipennis Surc. 1919 nom. nud. = discus Wied. 1828
 interpunctus Lutz 1918 nom. nud. = ornativentris Kröb. 1929
 lividus Walk. 1848 = importunus Wied. 1828
 macquarti Kröb. 1930 Not Schiner 1886 = lutzi Kröb. 1934
 melanocnemis Barr. 1957 = crassicornis Wied. 1821
 monochroma Wied. 1828 = fuscus Wied. 1819
 monogramma Wied. 1828 p. 150 = importunus Wied. 1828 p. 127
 multimaculatus Lutz 1909 nom. nud. = guyanensis Macq. 1846
 neoinnotescens Kröb. 1931 = corpulentus Brèthes 1910
 nigropalpis Kröb. 1931 Not nigripalpis Macq. 1846 = subviolaceus Fchld. 1961
 nubeculipennis Kröb. 1931 = nebulosus DeG. 1776
 piceus Thunb. 1827 = fuscus Wied. 1819
 pulverulentus Big. 1892 = olivaceiventris Macq. 1847
 punctum Rond. 1848 = olivaceiventris Macq. 1847
 robustus Kröb. 1929 Not Taylor 1919 = fortis Fchld. 1961
 rubrinotatus Big. 1892 = guyanensis Macq. 1846
 rufoniger Walk. 1850 = discus Wied. 1828
 semisordidus Walk. 1854 = importunus Wied. 1828
 senior Walk. 1850 = pellucidus Fab. 1805
 simplex Big. 1892 Not Walk. 1850 = indecisus Big. 1892
 surinamensis Macq. 1838 = nebulosus DeG. 1776
 tenens Walk. 1850 = glaucus Wied. 1819
 transversalifuscatus Kröb. nom. nud. = nebulosus DeG. 1776
 valterii Macq. 1838 = importunus Wied. 1828
 viduus Walk. 1850 = piceiventris Rond. 1848
 viridescens Kröb. 1931 = olivaceiventris Macq. 1847

CHECK LIST OF EXCLUDED NAMES, WITH REASONS

amapaensis Fairchild. Long appendix at fork.
 antarcticus Linnaeus. Long appendix. Scutellar spot present.
 bigoti Bellardi 1859. Not east of Andes.
 brevifrons Kröber 1931. Still unrecognized. 14 mm. Said to be like
 piceiventris Rond. but smaller. Rio de Janeiro.
 brevitrianguliferus Kröber 1931. Still unrecognized. 14 mm. Male from
 Venezuela, destroyed; female loc. unknown, lost.
 campestris Brèthes 1910. Not north of Argentina. Lineola group.
 chalcotrix Fairchild 1961. Long appendix.
 fumomarginatus Hine 1920. Scutellar spot present.
 fuscofasciatus Macquart 1838. Mostly Paraguay, Uruguay and Argentina.
 An as yet unresolved species complex of brown species with mid-
 dorsal black abdominal integumental stripe.
 hirtitibia Walker 1850. Mainly Andean, related to bigoti.
 lineifrons Lutz 1912. Long appendix.

- macquarti Schiner 1868. Mainly Central American, Bigoti group.
 melanogaster Brèthes 1910. Argentina; too small; fuscofasciatus group.
 miles Wiedemann 1828. Long appendix; rather small.
 mucronatus Fairchild 1961. Too small. Abdomen pointed.
 neglectus Kröber 1931. Still unrecognized, 11-13 mm. Too small.
 neovestitus Kröber 1931. 15 mm., long appendix, unknown locality.
 nigrofemoratus Kröber 1929. Male. Bolivia, probably in fuscofasciatus complex.
 pachypalpus Bigot. Ecuador; bigoti group.
 perplexus Walker 1850. Andean; bigoti group.
 peruvianus Macquart 1848. Andean; bigoti group.
 prunicolor Lutz 1912. A Stypommisa.
 pseudoculus Fairchild 1942. Long appendix; scutellar spot.
 rubidus Macquart 1847, not Wiedemann 1821. Still unrecognized. Guyane Fr. Type headless.
 rubripes Macquart 1838. Long appendix; scutellar spot.
 sorbillans Wiedemann 1828. Long appendix.
 strigimaculus Fairchild 1942. Long sspendix.
 surifer Fairchild 1964. Andean and Central America; bigoti group.
 tenuistria Kröber 1931. Espirito Santo. 16 mm. Type lost. Still unrecognized.
 thiemeana Enderlein 1925. Andean; bigoti group.
 unipunctatus Bigot 1892. Scutellar spot. Small.
 vestitus Wiedemann 1819. Long appendix.
 weyrauchi Barretto 1949. Andean; bigoti group.

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AND

MAPS

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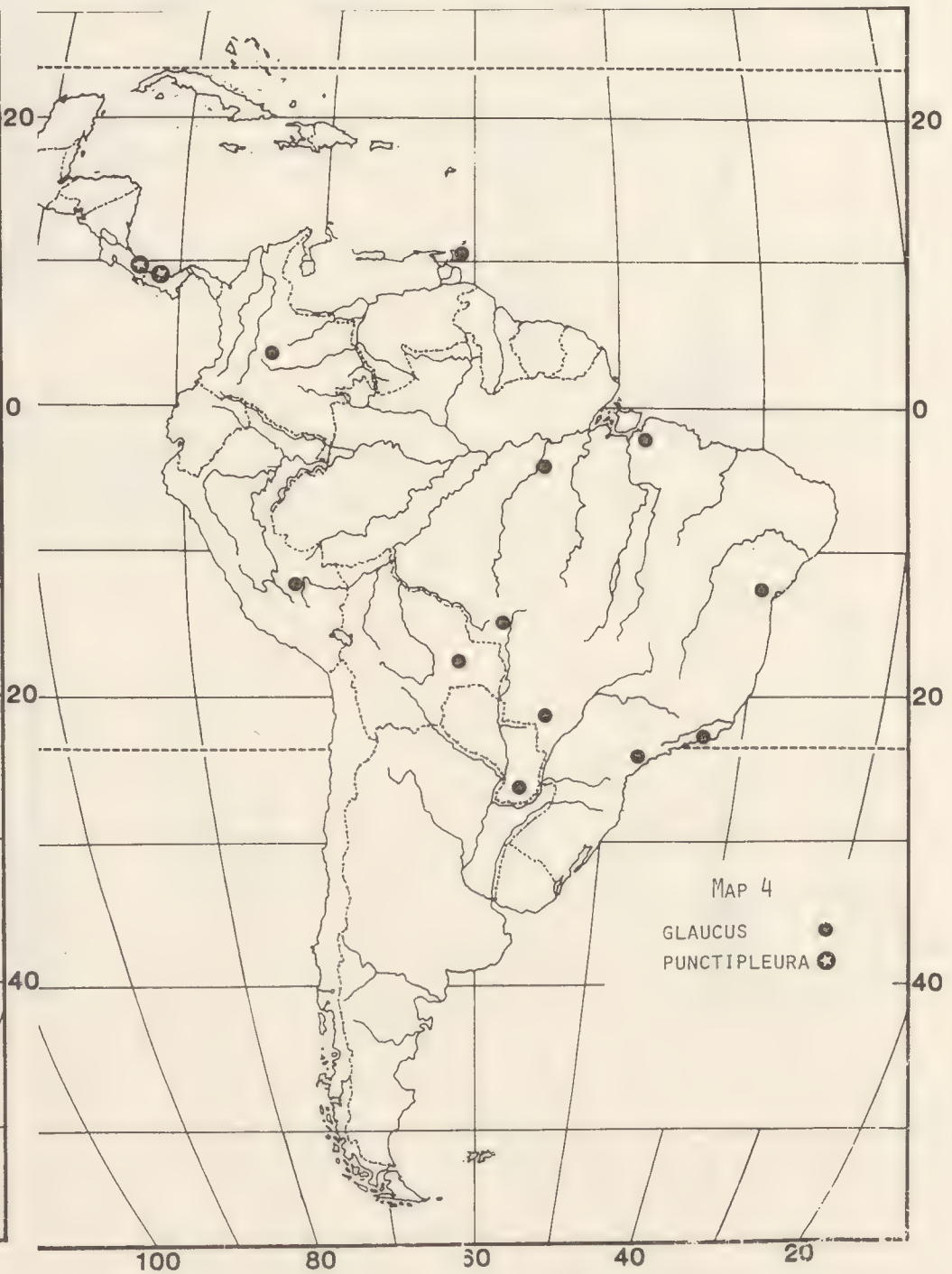
- Fig. 1. T. amazonensis Barr., Brasil, Amazonas, Manaus, Reserva Ducke, 30-VI-1970, T. Pimental coll.
- Fig. 2. T. angustifrons Macq. Brasil, Amazonas, Rio Branco, Sororoca, 1-IX-24, J. Bequaert coll., homotype, det. as alboater Wlk. by J. Bequaert.
- Fig. 3. T. discifer Walk., Brasil, Pará, Ilha do Marajó, compared and agreeing with types of discifer Walk. and albomaculatus Walk.
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- Fig. 9a. Male palpus of T. fuscus, Brasil, Sta. Catarina, Nova Teutonia 28-I-1960, Plaumann coll.
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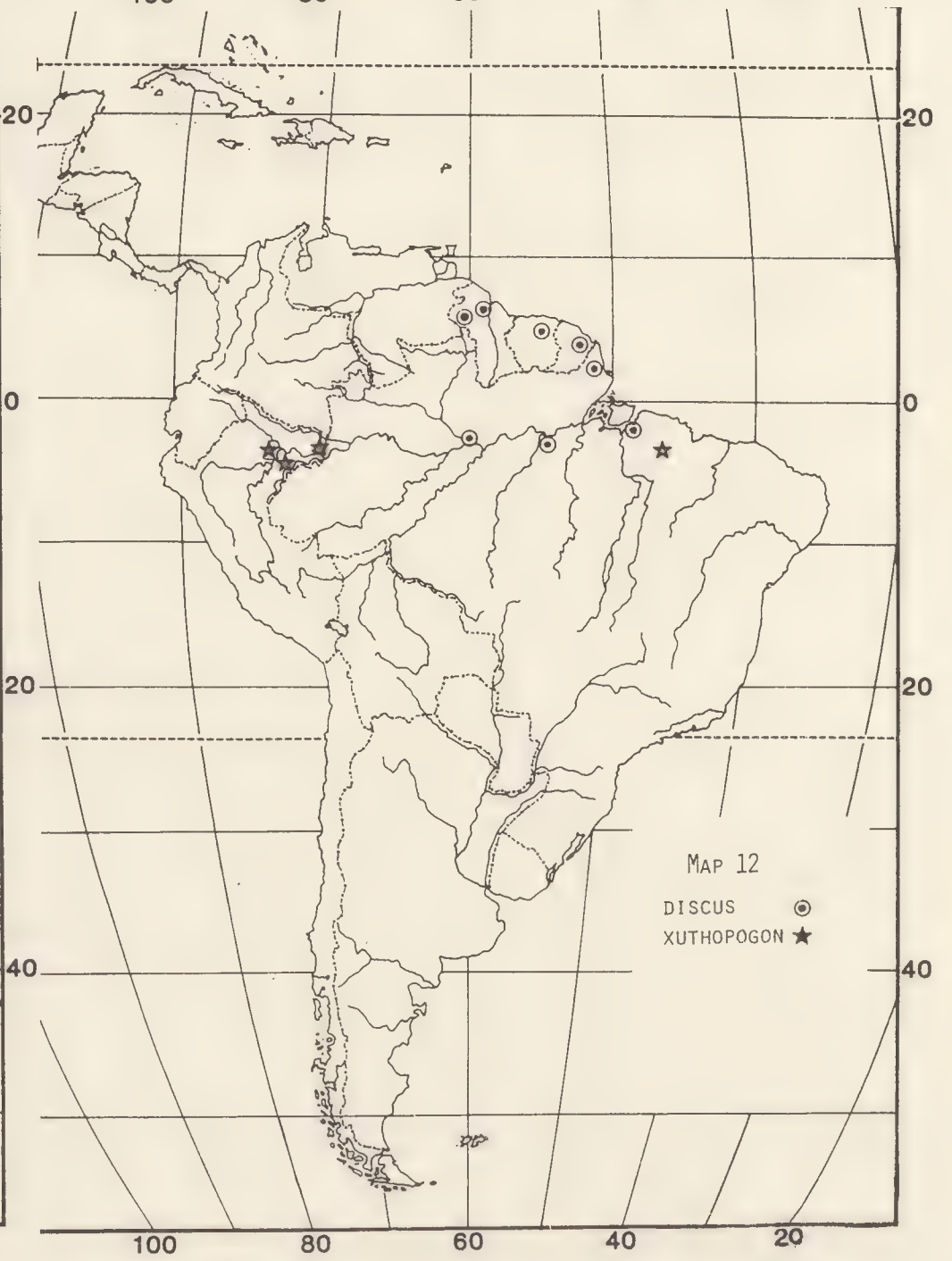
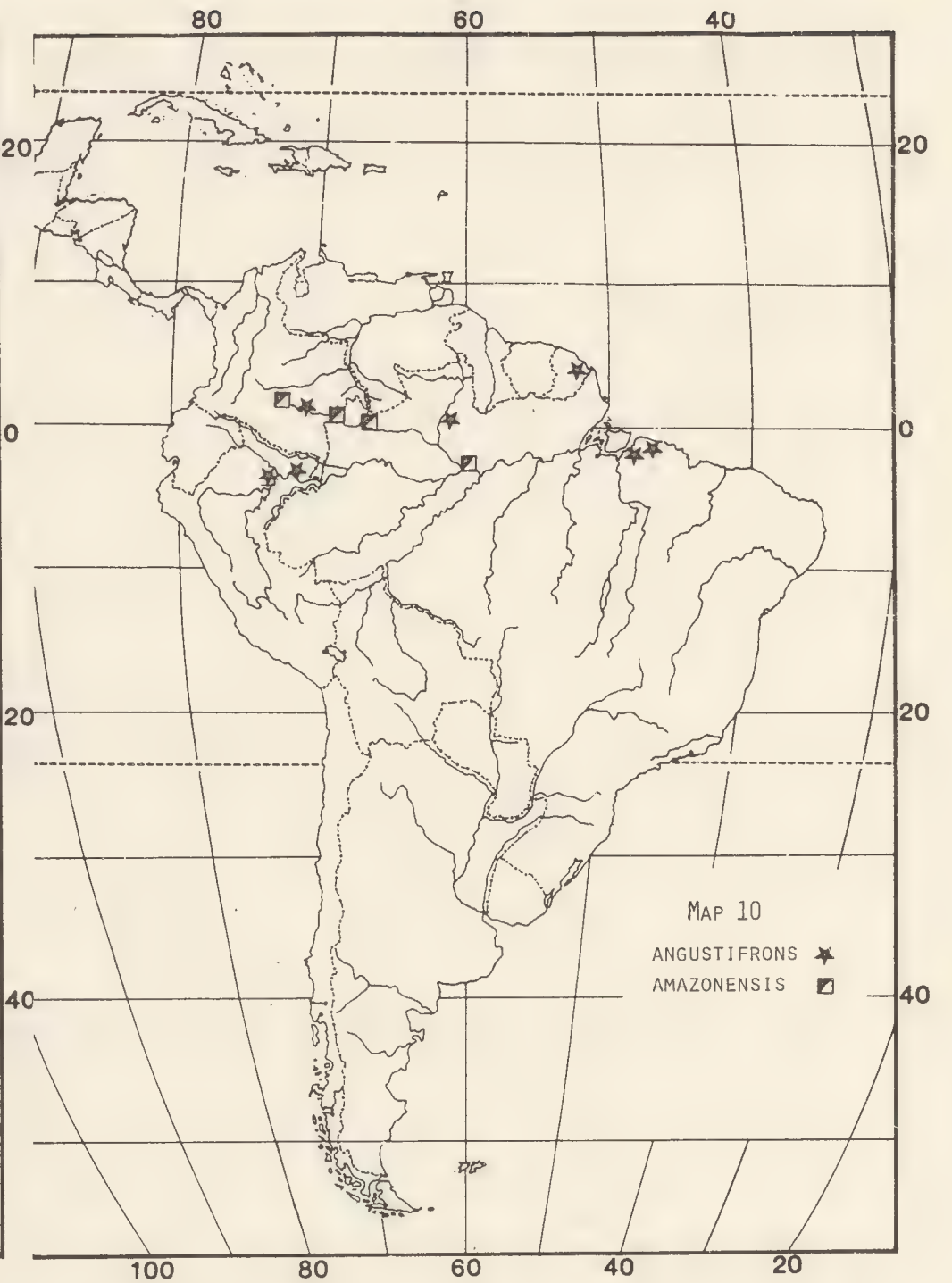
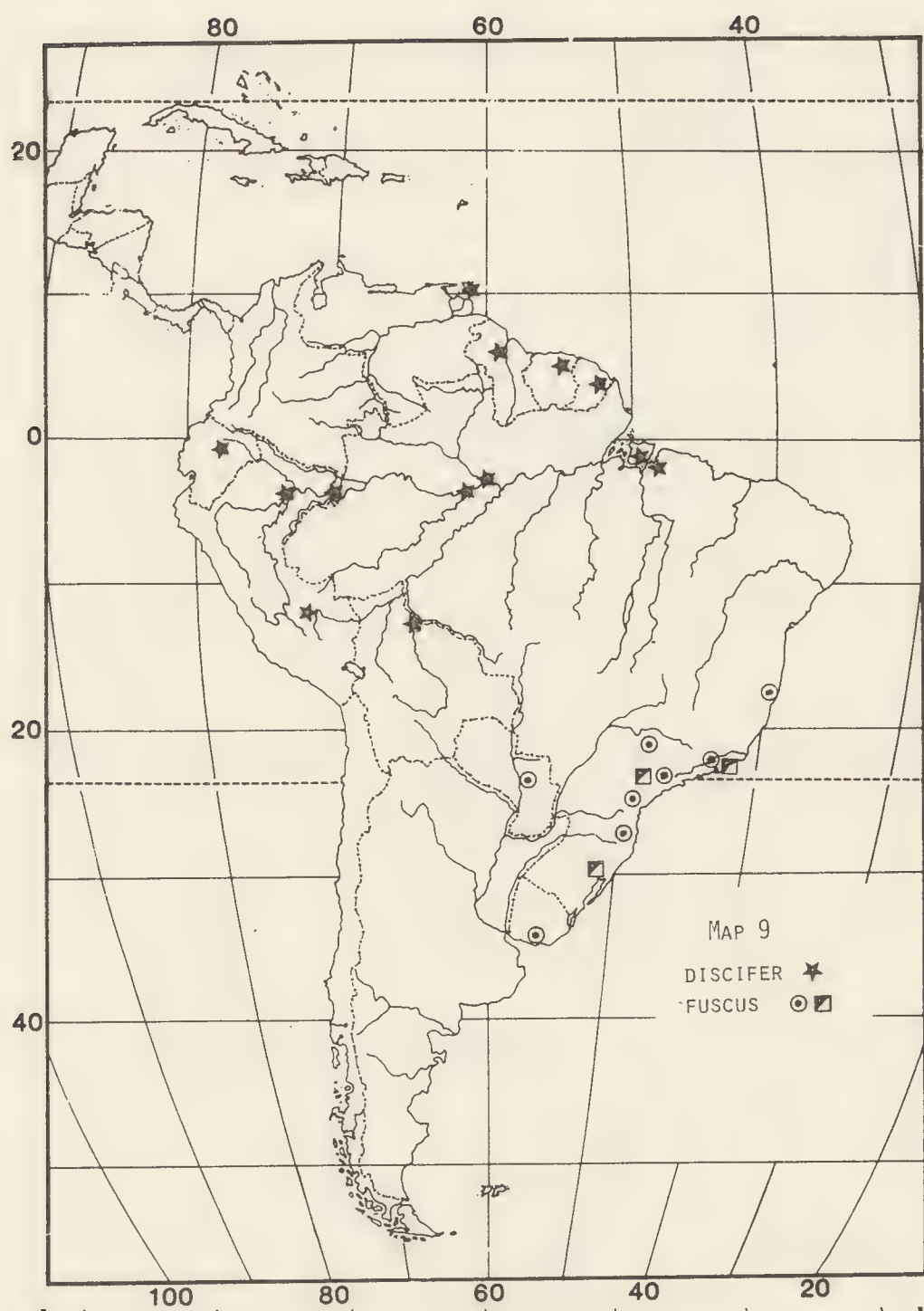
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- Fig. 17. T. olivaceiventris Macq. Brasil, Pará, Belém, 2-IX-43, R. M. Gilmore coll., compared and agreeing with types of imponens Walk. and pulverulentus Bigot in London.
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A REVISION OF THE SOUTH AMERICAN SPECIES IN THE GENUS NEOATHYREUS HOWDEN AND MARTÍNEZ (COLEOPTERA, SCARABAEIDAE, GEOTRUPINAE)

By
Henry F. Howden¹

ABSTRACT

Fourty-four South American species are included in the genus Neoathyreus Howden and Martínez. Twenty-one previously proposed names are considered valid and five are considered synonyms. Twenty-three new species are described: accinctus from Colombia; acutus from Bolivia, Brazil, and Peru; anfractus from Brazil; boosi from Ecuador; brazilensis from Brazil; caesariatus from Brazil; cuspinotatus from Brazil; glaseri from Ecuador; illotus from Brazil, Guyana, and French Guiana; inermis from Brazil and Peru; latidorsalis from Brazil; lepidus from Argentina; lingi from Ecuador; lobus from Argentina; martinezorum from Argentina and Bolivia; obscurus from Brazil; ornatus from Peru; peckorum from Colombia; perryae from Ecuador and Peru; politus from Brazil; rufobrunneus from Ecuador and Peru; rufoventris from Peru; and versicolor from Ecuador. One new species, perryae, is not only represented by recently collected material but is also known by a pronotum from the Talara tar seeps, Peru, dated at 14,000 years B.P. All species are illustrated by Scanning Electron Micrographs.

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INTRODUCTION

The tribe Athyreini was characterized by Howden and Martínez (1963) with four included genera; *Athyreus* Macleay, *Neoathyreus* Howden & Martínez, *Parathyreus* Howden and Martínez, and *Pseudoathyreus* Howden and Martínez. Subsequently *Athyreus* (Howden & Martínez, 1978) and *Parathyreus* (Howden, 1985) were completely revised and the Central American and West Indian Athyreini reviewed (Howden, 1964, 1978). The present revision completes the coverage of the New World species of Athyreini. The African-Oriental genus *Pseudoathyreus* still needs study.

Types of all of the species of *Neoathyreus* have been seen and most dissected except for the three described by Macleay and *flavithorax* (Arribalzaga). The Macleay types could not be found but it is possible that they are in his collection currently in Sydney, Australia. The three names were applied with some confidence based not only on Macleay's descriptions and localities but also on the same names being used on some of the older material seen by Macleay's contemporaries. The type of *flavithorax* was thoroughly described and subsequently it has been compared to a closely allied species by Martínez (1951); its placement is not in doubt.

This project was started and all material borrowed with the expectation that Antonio Martínez would be able to join me as co-author. Unfortunately at the last moment other commitments prevented him from coming to Ottawa. With all of the types and material at hand it was necessary to complete the project without his able assistance.

In previous papers on Athyreini the lack of series or of specimens with good data has been discussed and this paucity of material continues to be a problem. The number of species in the present paper represented by one or two specimens each indicates that the present coverage of the genus is probably far from complete.

Neoathyreus Howden and Martínez

Neoathyreus Howden and Martínez, 1963, p. 350.

Type-species: *Athyreus tridentatus* Macleay, by original designation.

Species placed in the genus can be recognized by the following combination of characters: sexes similar; head in most species trituberculate, carinate between tubercles; pronotum anteriorly with fossa on each side near margin behind eye; lateral pronotal marginal bead complete or briefly interrupted near lateral fovea, fovea shallow; pronotum in many species with median concavity; elytra lacking abrupt, transverse basal carina, carina if present incomplete or rounded; elytra in most species lacking deep striae, few species with five distinct striae on elytron; under surface

of fore tibia smooth, in a few species moderately, irregularly punctate; small carina present at ventral base of apical tooth of fore tibia, indistinct carina usually present at base of penultimate tooth; fore coxa not extending to pronotal margin; fore coxal cavity rounded laterally and with spine at outer posterior margin; metasternum flat to slightly convex medially, median line faintly indicated, edge of anterior declivity bluntly to sharply pointed; hind tarsi moderately thickened, not densely punctate; single, longitudinal carina present on the first, usually the second and rarely the third tarsal segments, never present on the fourth; largest tibial spur variable in length, extending from middle to beyond second tarsal segment.

Members of Neoathyreus can usually be recognized by the lack of the distinct, basal margin of the elytra; fore coxae not visible through lateral fovea; and fore coxal cavity with distinct spine on outer margin. The moderate size of most species and similarity in the sexes are also useful for recognizing the genus.

Explanation of special terms

Most species of Neoathyreus have three clypeal tubercles (Figs. 1-3): a lateral tubercle present on each side above the base of the mandible and a median tubercle that may be either anterior to the line between the lateral tubercles, or in line with them, or obsolete. In the descriptions, if the median tubercle is said to be anterior in position, it is anterior to the line of the lateral tubercles.

A posterior clypeal carina extends between the three tubercles or between the lateral tubercles if the median tubercle is obsolete. In addition, an oblique clypeal carina (Fig. 1) may extend from each side of the median tubercle anteriorly to the anterior lateral clypeal angle. In other species there is an anterior transverse clypeal carina (Fig. 2) extending across the anterior edge of the clypeus. Occasionally the carina is interrupted medially or only vaguely indicated (Fig. 3).

The pronotum usually has a central depression or concavity. On each side of the concavity, extending from the anterior third nearly to the posterior margin is a carina varying considerably in shape between species. The carina on each side of the concavity is referred to as the inner carina. In most species there are one or two carinae between the inner carina and the lateral pronotal margin. This single (or double) carina(e) is referred to as the outer carina(e). Below the lateral pronotal fovea the pronotal margin (Fig. 4) may be abruptly indented and the marginal bead absent. Other species lack the indentation and have the bead complete.

The etymology of all new scientific names except patronyms can be found in Brown (1956).

COLLECTIONS STUDIED

In citing collections studied, the name of the city in which the museum is situated is used, and for a private collection the name of the individual is cited. The collections studied and the curators are as follows:

Berlin

Zoologisches Museum an der Humboldt-
Universität zu Berlin. Dr. Manfred Uhlig.

Brussels	Institut Royal des Science Naturelles. Dr. L. Baert.
Cambridge	Museum of Comparative Zoology, Harvard University. Dr. A. Newton.
Chicago	Field Museum of Natural History. Drs. S. Ashe, J. Kethley.
Dresden	Staatliches Museum für Tierkunde. Dr. R. Krause.
Eberswalde	Institute für Pflanzenschutzforschung. Dr. G. Morge.
Geneva	Muséum D'Histoire naturelle. Dr. Ivan Löbl.
Leiden	Rijksmuseum van Natuurlijke Historie. Dr. J. Krikken.
London	British Museum (Natural History). Mr. L. Jessop.
Maracay	Instituto de Zoología Agrícola. Dr. F. Fernandez-Yepez, Mr. Jose A. Clavijo A.
Munich	Zoologische Staatssammlung. Dr. G. Scherer.
New York	American Museum of Natural History. Dr. Lee Herman.
Ottawa	Biosystematics Research Institute. Dr. A. Smetana.
Oxford	Hope Entomological Collections, University Museum. Dr. M.J. Scoble.
Paris	Muséum National d'Histoire Naturelle. Drs. R.-P. Dechambre, Y. Cambefort, Mr. Patrick Arnaud.
Pittsburgh	Carnegie Museum of Natural History, Mr. R.L. Davidson.
San Francisco	California Academy of Sciences. Dr. D. Kavanaugh.
São Paulo	Museu de Zoologia, Universidade de São Paulo. Dr. U. Martins.
Tucumán	Universidad Nacional de Tucumán. Dr. A. Willink.

Toronto	Royal Ontario Museum. Dr. G. Wiggins.
Washington	United States National Museum. Drs. R. Gordon, P. Spangler.
Arnaud	Mr. P. Arnaud, Paris, France.
Boos	Mr. J. Boos, Quito, Ecuador.
Glaser	Dr. J. Glaser, Baltimore, Maryland.
Hardy	Dr. A. Hardy, Sacramento, California.
Ratcliffe	Dr. B. Ratcliffe, Lincoln, Nebraska.

Key to the species of Neoathyreus H. & M.

- 1. Pronotum on each side with carina anterior to lateral fovea
extending to lateral marginal bead (ridge); carina at least
as high as marginal bead at junction 2
Pronotum on each side with or without carina anterior to
lateral fovea, carina if present not extending to and
merging with marginal bead 9
- 2. Pronotal midline not with elevated keel along midline posterior
to anterior margin; small to moderate sized species not
exceeding 15 mm in length 3
Pronotal midline posterior to anterior margin with strongly
elevated, elongate keel (Fig. 7) on anterior third; size
large for genus, over 15 mm in length; western Ecuador . .
. 1. glaseri n. sp.
- 3. Pronotum with inner carina on each side of concavity with
sharply obtuse, elevated angle near anterior end 4
Pronotum with inner carina on each side of concavity lacking
abrupt, elevated angle 5
- 4. Apical tarsomere of posterior tarsus with distinct tubercle on
upper surface near apex (Fig. 12); median clypeal tubercle
elevated above posterior carina, tubercle with acute apex;
Argentina, Paraguay 2. arribalzagai (Martínez)
Apical tarsomere of posterior tarsus lacking tubercle; median
clypeal tubercle with apex obtusely angled or transverse;
Argentina, Brazil, Paraguay, Uruguay
. 3. flavithorax (Arribalzaga)
- 5. Dorsal color of various shades of brown or black, elytra
occasionally with vague purple sheen 6
Dorsal color green or brownish with distinct greenish tinge;
Brazil 4. viridis (Boucomont)

6. Pronotum with inner carina at or near anterior fourth bent toward lateral margin; specimens dorsally tan to brown 7
 Pronotum with inner carina in anterior half not abruptly bent toward lateral margin; specimens very dark brown or black 8
7. Pronotum (Fig. 21) with inner carinae separated from each other at narrowest point by three or more times width of one carina at that point; pronotum moderately concave between inner carinae in anterior two thirds; Bahia, Brazil 5. anfractus n. sp.
 Pronotum (Fig. 22) with inner carinae separated from each other at narrowest point by one and one-half to two times width of one carina at that point; pronotum feebly concave between inner carinae; Mato Grosso, Brazil 6. latidorsalis n. sp.
8. Pronotum with each inner carina very broad, separated from adjacent posterior outer carina by no more than width of outer carina (Fig. 26); Bahia, Brazil 7. purpureipennis (Westwood)
 Pronotum with each inner carina of moderate width, separated from adjacent posterior outer carina by two or more times width of outer carina (Fig. 29); Bahia, Brazil 8. anthracinus (Klug)
9. Pronotum with only inner carina on each side of concavity present 10
 Pronotum with both inner and outer carina present, outer carina sometimes appearing as laterally directed posterior extension of inner carina 13
10. Pronotum with small to moderate sized tubercle on or just posterior to anterior margin at midline; dorsally brown, variegated, or black 11
 Pronotum with large (0.5 mm or more), laterally compressed tubercle (Fig. 32) or ridge with sharp posterior apex; dorsally brown; Minas Gerais, Rio de Janeiro, Brazil 9. cuspinotatus n. sp.
11. Fore tibia with five or more teeth on outer margin; pronotal concavity distinctly wider anteriorly 12
 Fore tibia with four teeth on outer margin; pronotal concavity (Fig. 35) only slightly wider anteriorly; Rio de Janeiro, Brazil 10. bidentatus (Macleay) (in part)
12. Each inner pronotal carina inwardly angulate or sinuate near middle; carinae not obviously divergent near anterior end; length usually exceeding 8.3 mm; dorsally tan to brown; Argentina, Paraguay 11. sexdentatus (Laporte)
 Each inner pronotal carina arcuate; carinae divergent anteriorly; length usually less than 8.3 mm; bicolored brown to black or nearly uniformly very dark brown or black; Bolivia, Brazil 12. centromaculatus (Felsche)

13. Pronotal midline with tubercle or longitudinal keel posterior to and not contiguous with anterior margin (small additional tubercle may also be present on anterior margin) 14
 Pronotal midline frequently with tubercle or low keel on or contiguous with anterior margin (bead), lacking more posterior median projection 20
14. Midline of pronotal concavity with tubercle or keel present on or near posterior margin of concavity; second tubercle may also be present on anterior margin at midline 15
 Midline of pronotal concavity with laterally compressed tubercle or keel present at anterior end or middle of concavity; in species with anterior tubercle, tubercle not contiguous with margin 17
15. Posterior pronotal tubercle peg-like, sides almost parallel to rounded apex; dorsum usually bicolored, sides of pronotum tan to brown, remainder of dorsum darker . . . 16
 Posterior pronotal tubercle forming an anteriorly directed keel, top same height as and merging with inner carinae (Fig. 45); dorsum relatively uniform tan or brown; Colombia 13. peckorum n. sp.
16. Anterior pronotal marginal bead not thickened or tuberculate at midline; surface of concavity becoming gradually less punctate-tuberculate toward posterior of concavity (Fig. 48); Venezuela 14. corniculatus (Felsche)
 Anterior pronotal marginal bead thickened posteriorly into V-shaped tubercle (V sometimes very small); surface of concavity becoming abruptly less punctate-tuberculate near posterior of concavity (Fig. 51); Argentina 15. lobus n. sp.
17. Clypeus with median tubercle absent or lower than lateral tubercles; pronotal tubercle on midline near anterior third; concavity posterior to tubercle 18
 Clypeus with median tubercle strongly developed, anterior in position to lateral tubercles; pronotal tubercle or keel on midline near middle; concavity poorly developed, shallow, lateral and posterior to tubercle 19
18. Lateral pronotal margin below fovea indented, marginal bead interrupted; inner pronotal carina sinuate (Fig. 54); Colombia 16. reichii (Westwood)
 Lateral pronotal margin at most slightly indented below fovea, marginal bead not broken; inner carina on each side of concavity elevated and acutely angulate near middle of concavity (Fig. 58); Colombia . . 17. pholas (Westwood)
19. Pronotal midline near center with keel slanted posteriorly, longer than high (Fig. 61); inner carina on each side obtusely angulate (depressed) in line just posterior to

- posterior end of keel; Colombia, Peru . .18. centralis (Westwood)
Pronotal midline near center with upright, blade-like
tubercle higher than long (Fig. 66); inner carina on
each side arcuate, lacking angles; Ecuador 19. lingi n. sp.
20. Clypeus on each side with strongly developed oblique carina
extending up anterior lateral side of prominent median
tubercle; tubercle more prominent (higher) than lateral
tubercles, with anterior face vertical or nearly so 21.
Clypeus on each side lacking oblique carina or with the
carina broken or very irregular near base of low median
tubercle; tubercle slightly anterior to lateral tubercles
and at most only slightly better developed 27
21. Pronotum on each side of concavity with inner carina
sharply angulate 22
Pronotum on each side of concavity with inner carina
lacking sharp angulation 24
22. Sharp angulation of inner carina acute, slanted toward
midline; lateral thirds of pronotum lighter in color 23
Angulation of inner carina nearly vertical, right angled
or obtuse; pronotal color almost uniform. 45
23. Inner carina posterior to angulation with distinctly delimited
inner margin; lateral clypeal tubercles unusually
prominent, upright (Fig. 72); Ecuador 21. boosi n. sp.
Inner carina posterior to angulation lacking clearly delimited
inner margin; lateral clypeal tubercles small, slanted
anteriorly (Fig. 73); Santa Catarina, Brazil
. 22. catharinae (Bates)
24. Length usually less than 12 mm; anterior pronotal margin
with tubercle on midline small 25
Length usually greater than 12 mm; anterior pronotal
margin with tubercle on midline pronounced 26
25. Elytral intervals shining; fore tibia with five or more teeth;
pronotum (Fig. 76) with short, distinct secondary carina
at right angle to margin anterior to lateral fovea;
Argentina, Brazil 23. corinthius (Klug)
Elytral intervals dull; fore tibia with four teeth; pronotum
(Fig. 35) lacking carina anterior to fovea; Brazil
. 10. bidentatus (Macleay) (in part)
26. Pronotal concavity (Fig. 80) closely punctate in anterior
two-thirds; sides of concavity near middle tumid on
each side of depressed midline; Brazil . 24. tridentatus (Macleay)
Pronotal concavity (Fig. 83) with, at most, only small
scattered punctures, surface appearing highly polished;
bottom of concavity almost flat, not tumid at sides;
Brazil 25. politus n. sp.

27. Fore tibia with four teeth on outer margin (an obtusely angled basal swelling is not considered a tooth) 28
Fore tibia with five or more teeth on outer margin 34
28. Lateral pronotal margin with marginal bead broken (absent) below fovea 29
Lateral pronotal margin with marginal bead unbroken (may be shallowly indented) 30
29. Clypeus on each side anteriorly with poorly defined oblique carina extending toward median tubercle; pronotum as in Fig. 86; dorsum tan or brown; northern South America to Mexico 26. excavatus (Laporte)
Clypeus anteriorly with transverse carina; pronotum as in Fig. 89; dorsum dark brown or black; northern South America, Panama 27. lanei (Martínez)
30. Clypeus with anterior carina(e) lacking or with poorly defined oblique carina on each side; dorsum of uniform color or variegated 31
Clypeus anteriorly with transverse carina (Fig. 92); dorsum with sides of pronotum lighter in color; Goyas, Brazil 28. obscurus n. sp.
31. Pronotum and elytra densely setose (typical for genus), most setae longer than five times width of one pronotal puncture or granule 32
Pronotum (Fig. 97) and elytra, except near margins, with fine, short to minute, inconspicuous setae; most setae no more than three times as long as width of one pronotal granule; western Peru 29. ornatus n. sp.
32. Small species less than 12 mm in length; pronotum on each side with inner carina posteriorly not abruptly bent toward middle 33
Moderate sized species over 12 mm in length; pronotum on each side with inner carina posteriorly bent inwardly, and extending to midline (Fig. 98); Brazil . 30. caesariatus n. sp.
33. Pronotum laterally with fine carina at right angle to margin anterior to fovea, carina not obviously fusing with marginal bead (Fig. 101); dorsum uniformly brown to dark brown; Brazil, French Guiana 31. illotus n. sp.
Pronotum laterally lacking carina just anterior to fovea (Fig. 104); dorsum variegated tan to very dark brown; Ecuador 32. versicolor n. sp.
34. Pronotum laterally with marginal bead broken (absent) below fovea 35
Pronotum laterally with marginal bead unbroken 39
35. Pronotum with inner carinae lacking upright, sharp angulations 36

Pronotum on each side with inner carina with upright, sharp, acute angle near anterior end of carina (Fig. 107); Argentina, Bolivia	33. <u>martinezorum</u> n. sp.	
36. Pronotum on each side with inner carina inwardly bowed or angulate and thickened near middle of carina, dorsum (in non-teneral specimens) very dark to black		37
Pronotum on each side with inner carina not noticeably inwardly bowed or angulate near middle, carina of relatively uniform width; dorsum tan to brown or bicolored		38
37. Elytra punctate-granulate, small punctures obvious, surface appearing only moderately roughened, dull; pronotum as in Fig. 110; Ecuador	34. <u>latecavatus</u> (Boucomont)	
Elytra closely granulate, very rough, shining; pronotum as in Fig. 113; Ecuador, Peru	35. <u>rufobrunneus</u> n. sp.	
38. Inner pronotal carina (Fig. 120) arcuate or very slightly sinuous, gradually convergent with opposite carina posteriorly, less so posterior to concavity; clypeus anteriorly with partial to complete transverse carina . . .		44
Inner pronotal carina (Fig. 116) strongly curved inwardly in posterior half before becoming parallel to midline posterior to concavity; clypeus anteriorly on each side with trace of oblique carina; Ecuador, Peru . . .	36. <u>perryae</u> n. sp.	
39. Clypeus with median tubercle absent or distinctly smaller and lower than lateral tubercles		40
Clypeus with median tubercle as high or higher than lateral tubercles		41
40. Clypeus with three tubercles; pronotum (Fig. 123) with posterior edge of inner carina angulate near midline; Ecuador, Panama	38. <u>lyriferus</u> Howden & Gill	
Clypeus with two tubercles (three in small specimens); pronotum (Fig. 126) with posterior edge of inner carina rounded near midline; Colombia	39. <u>accinctus</u> n. sp.	
41. Pronotum with inner carina on each side unbroken, uninterrupted		42
Pronotum (Fig. 129) having two inner carinae on each side, one carina anterior and more lateral in position and ending near posterior third of pronotum, second carina on same side much closer to midline and with anterior end beginning just anterior to posterior end of anterior carina; Argentina	40. <u>lepidus</u> n. sp.	
42. Inner pronotal carina inwardly angulate near middle, sinuous, or arcuate		43
Inner pronotal carina (Fig. 132) with an abrupt, upwardly directed angulation near anterior end of carina; Bolivia	41. <u>acutus</u> n. sp.	

43. Inner pronotal carina not inwardly angulate or bent inwardly and thickened near middle 44
 Inner pronotal carina (Fig. 135) inwardly angulate or bent inwardly and thickened near middle; Brazil
 42. brazilensis n. sp.
44. Inner pronotal carina (Fig. 120) slightly arcuate outwardly and very gradually converging with opposite carina to end of concavity near posterior third of pronotum; dorsum tan to brown; widely distributed to Amazon region and south to Argentina 37. lanuginosus (Klug)
 Inner pronotal carina (Fig. 138) most widely separated from opposite carina at anterior end, then converging toward midline to middle of pronotum, then carina nearly parallel with midline to posterior end of carina; dorsum very dark brown with sides of pronotum reddish brown; Brazil, Peru 43. inermis n. sp.
45. Anterior pronotal margin between fossae appearing obtusely angled at midline when viewed from posterior, apex of angulation with small tubercle (Fig. 69); Goyas, Brazil 20. goyasensis (Boucomont)
 Anterior pronotal margin evenly arched between fossae; tubercle at midline lacking (Fig. 141); Peru
 44. rufoventris n. sp.

1. Neoathyreus glaseri n. sp.

Figures 7-10, Map 1

HOLOTYPE. Male, length 19.1 mm, greatest width 12.5 mm. Dorsally black, with bluish or purple tinge along margins of elytra, most pronounced laterally. Clypeus with oblique and posterior carina strongly developed; median tubercle (worn) with anterior face rising vertically above clypeal margin; lateral tubercle on each side positioned above mandibular insertion, height only slightly less than median tubercle. Vertex between eyes deeply, broadly concave, concavity extending under edge of pronotal margin; sides of concavity granulate, central portion smooth; scattered, short setae present in granular areas near eyes. Pronotum (Figs. 7, 8) with distinct fossa on each side contiguous with anterior marginal bead behind eye; fossa four to five times width of adjacent bead, and with feeble groove directed posteriorly for approximately 0.5 mm; pronotal margin between fossae evenly arcuate, bead of uniform thickness, lacking tubercle at midline; midline 0.4 mm posterior to marginal bead with large, elongate, elevated keel, keel approximately 2.0 mm high, 2.5 mm long, top edge of keel generally parallel with pronotal surface on either side, area on either side of keel elevated, concavity present posteriorly. Inner pronotal carina on each side arising approximately 1.5 mm posterior to fossa, carina nearly parallel with midline to posterior third where inwardly arcuate to indented midline; outer posterior margin of each carina adjacent to midline with broad, posteriorly directed, angulate lobe; two inner carinae conjointly on each side of keel and surrounding broad, deep concavity posterior to keel; surface of concavity irregularly granulate, sparsely so in some areas near

sides; midline of concavity distinctly impressed, smooth. Pronotum on each side lateral to inner carina with two outer carinae; one carina present anterior to deep circular lateral fovea; carina merging with lateral bead of pronotal margin, extending two thirds of distance to inner carina near middle; posterior outer carina almost divided into two parts, 1.0 mm portion behind and slightly below lateral fovea, then 1.0 mm obsolete portion and a posterior 4.0 mm posterior portion positioned midway between posterior inner carina and lateral margin adjacent to posterior angle. Lateral pronotal margin on each side below fovea broadly, shallowly indented between junction of anterior outer carina with margin and abrupt median angle; marginal bead greatly reduced in indented portion of margin. Elytron with three or four striae feebly indicated by depressed irregular rows of punctures, most of surface coarsely, contiguously punctate; most punctures each with fine, short, inconspicuous seta. Metasternum between middle coxae very feebly convex, midline anteriorly forming low, sharp keel, anterior end sharp; anterior edge obtusely angled on either side of sharp point; surface of metasternum with moderate sized shallow punctures, each with relatively short reddish-brown seta. Fore tibia with six teeth on outer margin, teeth worn, basal tooth indistinct on right tibia. Genitalia as in figs. 9, 10.

ALLOTYPE. Female, length 15.0 mm, greatest width 8.9 mm. Dorsally black with distinct bluish tinge. Similar to holotype except as follows: clypeal tubercles smaller, less elevated; vertex with concave area reduced in size and depth, not extending to pronotal margin; pronotum with median keel reduced in height, concave area posterior to keel shallow, narrower than in male; inner carina on each side lower, much less strongly arcuate, inner carinae closer together; elytron with striae more pronounced; fore tibia with only five teeth on outer margin; pygidium more convex.

TYPE MATERIAL: Holotype, male, Ecuador, Santa Domingo, IV. 1982 (Howden). Allotype, female, Ecuador, Quinde [= Rosa Zarate] (Howden).

REMARKS. The unique, raised, anterior median pronotal keel and the odd outer carinae will immediately distinguish glaseri from other species of Neoathyreus. The closest relatives of glaseri probably are in the pholas complex, but it is not a close relationship.

The species is named for Dr. John Glaser who very generously gave me the holotype. He has also loaned me specimens of several other species used in this study.

2. Neoathyreus arribalzagai (Martínez)

Figures 11-14, Map 1

Athyreus arribalzagai Martínez, 1951, p. 109.

TYPE. Male, labeled "Argentina, Pcia de Corrientes, Dep. de Ituzaingo, isla Apipé Grande, XI-945"; in Martinez collection.

MALES. Length 9.5 to 12.1 mm, greatest width 6.2 to 7.9 mm. Color dorsally green with elytra occasionally light brown with distinct greenish color centrally. Clypeus with both oblique and posterior carinae strongly developed; median tubercle moderately elevated above lateral tubercles, apex narrow. Vertex almost flat, granular. Pronotum (Fig. 11) with small fossa on each side behind eye contiguous with anterior marginal bead; diameter of fossa equal to or slightly more than width of adjacent

marginal bead. Pronotum with inner arcuate carina on each side arising just posterior to fossa, carina rising abruptly to tubercle at anterior fifth, then inwardly arcuate to within 1.0 mm of posterior margin where it becomes parallel to slightly divergent, terminating approximately 0.1 mm before posterior marginal bead; concavity broad, shallowly concave in median two-thirds, midline feebly impressed, surface except near carinae closely granulate. Outer carina on each side divided into two parts of nearly equal length, posterior portion feebly arcuate, slightly closer to lateral posterior margin than to inner carina; anterior portion present anterior to lateral fovea and merging with lateral marginal bead; lateral pronotal marginal bead unbroken. Each elytron with four or five feebly elevated convex intervals between suture and humeral umbone, areas between intervals irregularly punctate-setose. Mesosternum between middle coxae slightly convex, anterior edge at midline obtusely angulate; surface with widely spaced, moderate sized setose punctures. Fore tibia with four teeth on outer margin. Hind tarsus with terminal segment with tubercle on dorsal surface (Fig. 12); a character apparently unique to this species. Genital capsule with apex angulate. Genitalia as in figs. 13, 14.

FEMALES. Length 9.4 to 12.9 mm, greatest width 6.3 to 8.1 mm. Differing only very slightly from males: median clypeal tubercle and inner pronotal carina slightly lower than in males of equal size; pygidium more convex.

MATERIAL EXAMINED: 4 males, 3 females.

BRAZIL - Amazonas: Humaitá (?) [probably Humaitá, Paraguay].

PARAGUAY - Alto Paraná: Kohenau. Caaguazú: Col. Sudetia, 320 m, XII. Sapucay. Villarrica, X.

Specimens are in: Geneva, London, São Paulo, Arnaud, Howden.

REMARKS. This species can be separated from all other Neoathyreus by the presence of a seemingly unique character; i.e., the apical segment of the hind tarsus has a distinct tubercle (Fig. 12) on the dorsal surface. If both hind tarsi are missing (as in most specimens seen) the species is close to all green specimens of flavithorax but can be separated from that species by the number of teeth on the outer margin of the fore tibia, four for arribalzagai, five or six for flavithorax.

3. Neoathyreus flavithorax (Arribalzaga)

Figures 15-17, Map 1

Athyreus flavithorax Arribalzaga, 1880, p. 146; Boucomont, 1932, p. 269; Martínez, 1951, p. 112.

TYPE. Sex not given. Buenos Aires, Argentina, probably in Buenos Aires.

MALES. Length 9.8 to 12.7 mm, greatest width 6.4 to 7.1 mm. Dorsally entirely green or with head, pronotal margins and elytra dark green to green, majority of pronotum light reddish brown to dark greenish brown. Clypeus with both oblique and posterior carinae strongly developed; median tubercle only moderately higher than lateral tubercles, blunt at apex, blunt apex varying in width from narrow to unusually wide, particularly so in all green specimens. Vertex very feebly, broadly concave; surface granulate, occasionally only feebly so near posterior midline. Pronotum (Fig. 15) with small fossa on each side behind eye contiguous with anterior marginal bead, fossa three to four times width of adjacent bead; anterior

margin at midline elevated to oblique, sharp angle or small tubercle. Pronotum with inner carina on each side arising approximately 0.5 mm behind margin in line with outer edge of gena; carina outwardly arcuate to sharp, elevated angle approximately in transverse line with lateral foveae, then inwardly arcuate to posterior sixth of pronotum where carina parallels midline, terminating approximately 0.1 mm before posterior marginal bead. Concavity between inner carinae broad, shallowly concave in median two-thirds, midline feebly, broadly impressed; surface variable, lateral portion adjacent to carinae smooth, median two-thirds finely granulate with scattered minute punctures in specimens with testaceous thorax to more coarsely punctate-granulate in specimens with totally green thoraxes. Outer pronotal carina on each side divided into two parts; posterior portion, midway between inner carina and posterior inwardly arcuate lateral angle, nearly straight and approximately 1.0 mm long; anterior portion about 0.9 mm in length, positioned just anterior to lateral fovea and fusing with lateral marginal bead; lateral pronotal marginal bead unbroken. Each elytron with two or three elevated intervals between suture and umbone except between raised intervals, striae obsolete; elytral surface, except for raised areas closely, irregularly punctate. Mesosternum between middle coxae slightly convex, anterior edge at midline obtusely angulate; surface with widely spaced, moderate sized punctures, each puncture with long seta. Fore tibia with five teeth on outer margin, basal teeth rounded and occasionally with vague, feebly arcuate swelling indicating basal sixth tooth. Genital capsule with elongate, acutely rounded, feebly reflexed, setose apex. Genitalia as in figs. 16, 17.

FEMALES. Length 9.2 to 12.5 mm, greatest width 5.7 to 7.0 mm. Differing only slightly from males; generally with posterior clypeal and inner pronotal carinae slightly less developed, lower; punctures on vertex and in concavity more pronounced; pygidium more convex.

MATERIAL EXAMINED: 17 males, 10 females.

ARGENTINA - Buenos Aires: Haedo. Carcarañá. Chaco de Santiago del Estero: Río Salado near Dilcano. Córdoba: La Falda, XII. Misiones: San Pedro, XI. Pampas. Sante Fé. Tucumán.

[BOLIVIA] - Santa Cruz: Pto. Alegre.

BRAZIL - Goiás: Rio Verde. Santa Catharina: Nova Teutônia, 27° 11'S, 52°23'W, I, II, III, IV, IX, XI, XII.

URUGUAY - Tacuarembó: Puntas de Laureles, XII.

Specimens are in: Brussels, Dresden, London, New York, Paris, San Francisco, São Paulo, Tucumán, Washington, Howden, Ratcliffe.

REMARKS. The species was originally described from Buenos Aires, but most of the specimens seen from Argentina come from Santiago del Estero. The majority of specimens from this area have the pronotum testaceous and the elytra with three or four distinctly raised intervals with the surface coarsely punctate between. However, totally green specimens also have been seen from the same localities as those with a testaceous thorax and all variations of clypeal and pronotal differences were noted in different combinations. All specimens seen from Uruguay and Brazil are entirely green and I originally considered them to be distinct. However, the male genitalia show no consistent differences and specimens in one population overlap in characters with those from different areas. Hence, I consider all of the forms as belonging to a single species, flavithorax.

In his original description, Arribalzaga (1878) mentions that the specimen he described was collected flying on a hot day at noon. This may

be typical behavior for the green or bicolored Neoathyreus, since similarly colored specimens in the other tribes of Geotrupinae (where all brown specimens are crepuscular or nocturnal) also fly during the day. I have observed this daytime activity in Australia in both Stenaspidius and Gilletinus and in South Africa in Parathyreus.

4. Neoathyreus viridis (Boucomont)

Figures 18-20, Map 1

Athyreus viridis Boucomont, 1902a, 185; 1902b, p. 584.

TYPE. Male, labeled "Athyreus viridis B. type; Jatahy, Prov. Goyas, Br sil; typus [red label]; Museum Paris 1938 Coll. A. Boucomont"; in Paris (MHNP).

MALES. Length 8.2 to 9.7 mm, greatest width 6.5 to 7.8 mm. Dorsally greenish brown to bright green. Clypeus with both oblique and posterior carinae strongly developed; median tubercle small, approximately equal in height or lower than lateral tubercles. Vertex flat, coarsely granular. Pronotum (Fig. 18) with small fossa on each side behind eye contiguous with and slightly interrupting anterior marginal bead, fossa approximately three times width of adjacent bead; anterior margin at midline with small conical tubercle. Pronotum with inner arcuate carina on each side flared outwardly anteriorly, anterior apex directed toward lateral margin, carina branched near anterior end, lateral branch of inner carina extending to lateral margin just anterior to fovea and fusing with marginal bead. Concavity between inner carinae shallow, elongate, wider anteriorly, surface mostly punctate-granulate. Outer pronotal carina strongly developed in posterior two-thirds, anterior end obsolete in places, terminating just posterior to lateral fovea; carina positioned almost evenly between inner carina and pronotal margin at and anterior to posterior pronotal angle; pronotal marginal bead of lateral margin unbroken. Each elytron with five, occasionally six, striae between suture and umbone; intervals feebly convex; sides of intervals and striae closely, irregularly punctate and finely setose, surfaces smooth between punctures, shining. Mesosternum between middle coxae very slightly convex, anterior edge sharply, obtusely angulate at midline; surface with scattered minute puncture, each puncture with long, fine, whitish seta. Fore tibia with four teeth on outer margin. Genital capsule with elongate, narrow apex. Genitalia as in figs. 19, 20.

FEMALES. Length 8.1 to 10.0 mm, greatest width 6.5 to 7.9 mm. Differing only slightly from males as follows: clypeal tubercles very slightly reduced in size, particularly median tubercle; pygidium more convex, apex more broadly arcuate.

MATERIAL EXAMINED: 6 males, 8 females.

BRAZIL - Goi s: Jata  (= Jatahy); Rio Verde; Su apara; Vian polis, III.

Specimens are in: Berlin, Dresden, Paris, S o Paulo, Howden.

REMARKS. While it is possible that black or brown forms of viridis exist (since black forms are found in other species that are usually green), none have been seen. Thus the combination of the green color and low, strongly developed arcuate or non-angulate inner and outer pronotal carinae (Fig. 18) is sufficient to separate viridis from all other species in the genus. While there are several other green species of Neoathyreus, these have upwardly angulate inner pronotal carinae and are not sibling species of

viridis. Possibly the closest relative of viridis is corinthius.

5. Neoathyreus anfractus n. sp.

Figure 21, Map 1

HOLOTYPE. Female, length 10.8 mm, greatest width 6.4 mm. Dorsally dark reddish brown with sides of pronotum tan, transition to tan gradual, not abrupt. Clypeus with both oblique and posterior carinae moderately developed, carinae thin; median tubercle with sharply rounded, narrow apex; anterior face of tubercle arising from anterior clypeal edge, face slightly slanted posteriorly; lateral tubercle on each side small, situated above posterior base of mandible. Vertex flat to unevenly, feebly convex; surface granulate-punctate, each small puncture at base of granule with long, erect, fine seta. Pronotum (Fig. 21) with moderate sized fossa on each side contiguous with anterior marginal bead behind eye, fossa two to three times width of adjacent bead; anterior pronotal margin between fossae moderately elevated to midline, midline with small conical tubercle with apex 0.1 to 0.2 mm posterior to marginal bead; anterior base of tubercle with poorly defined junction with posterior edge of marginal bead. Inner pronotal carina on each side arising 1.1 mm behind fossa, carina 0.3 to 0.4 mm wide, uniform in height, sinuous with anterior end strongly divergent from opposite carina; posterior to the divergent portions, each carina inwardly arcuate to about 1.5 mm from opposite carina, then feebly curved laterally, then feebly convergent, posterior ends of both inner carinae separated by approximately 1.0 mm, each terminating 0.5 mm before posterior pronotal margin. Pronotal concavity with deepest portion Y-shaped, each arm of "Y" deepest on each side midway between anterior median marginal tubercle and anterior end of inner carina, concavity then extending posteriorly to transverse punctate area between carina about 1.0 to 1.3 mm before posterior margin; surface of concavity granulate anteriorly, then gradually less so to nearly smooth posterior edge; all pronotal granules each with puncture at base with long, erect seta. Outer pronotal carina on each side divided in two portions; anterior part fusing with lateral marginal bead just anterior to lateral fovea, carina thin, about 1.5 mm long, ending just above lateral fovea; posterior portion of carina similar in width to inner carina, about 1.5 mm long, very slightly closer to lateral margin anterior to posterior angle than to adjacent inner carina. Lateral pronotal margin below fovea, broadly, shallowly, inwardly arcuate; marginal bead complete, not broken. Elytron with five or six moderately impressed striae, elytral surface coarsely punctate, punctures not limited to striae; each puncture with moderately long, semi-erect tan seta; surface between punctures smooth, shining. Metasternum between middle coxae feebly convex, anterior edge obtusely angled, apex of angle at midline with small tubercle; surface of metasternum with scattered small punctures, each with long, semi-erect seta. Fore tibia with four teeth on outer margin.

MALE. Unknown.

TYPE MATERIAL: Holotype, female, [Brazil], Pr. de Bahia, S. Antonio da Barra, Gounelle 11.XII.88 (Paris).

REMARKS. As discussed under latidorsalis, anfractus belongs to a small group of three closely related species, the third species being purpureipennis. Neoathyreus anfractus can be distinguished from either of these by the oddly shaped, sinuate, inner pronotal carina. The species is

probably most closely related to latidorsalis.

6. Neoathyreus latidorsalis n. sp.

Figures 22-25, Map 1

HOLOTYPE. Male, length 11.0 mm, greatest width 6.5 mm. Dorsally reddish-brown. Clypeus with both oblique and posterior carinae strongly developed; median tubercle in centre of clypeus only moderately elevated, apex worn; lateral tubercle on each side above base of mandible feebly developed. Vertex between eyes flat to feebly convex; surface minutely setose, coarsely granulate between eyes, punctate posteriorly between low carina on each side. Pronotum (Figs. 22, 23) with small fossa on each side behind eye contiguous with anterior marginal bead, fossa only slightly wider than adjacent bead; anterior pronotal margin between fossae gradually elevated to midline, small tubercle present at midline, base of tubercle merging with posterior edge of marginal bead. Inner pronotal carina unusually wide, 0.5 mm or more; anterior end arising approximately 0.8 mm behind fossa, carina strongly convergent with opposite carina, approaching within 0.2 mm of midline at about anterior third, then parallel with midline and opposite carina to posterior termination 0.6 mm before posterior pronotal margin; concavity between inner carinae very shallow, represented mainly by elongate, granulate-punctate depression along midline; granulate-punctate surfaces of pronotum with minute setae. Outer pronotal carina on each side divided into two portions, anterior section with lateral end fused with lateral marginal bead; carina extending inward as thin raised ridge immediately anterior to lateral fovea, length of carina 1.5 mm to 1.6 mm; posterior position of carina wide, similar to inner carina in appearance, about 1.5 mm long, wider posteriorly, positioned midway between lateral margin anterior to posterior angle and inner carina; lateral pronotal fovea shallow, margin below broadly, shallowly inwardly arcuate, marginal bead complete, not reduced. Elytron with four or five feebly impressed striae, surface of disc closely, coarsely punctate, each puncture with short, fine, black seta; surface between punctures smooth, shining. Metasternum between middle coxae convex, anterior edge obtusely angulate, apex of angulation with short, low ridge or tubercle; surface of metasternum with widely scattered minute punctures, some punctures with moderately elongate, fine setae. Fore tibia with four teeth on outer margin. Genitalia as in figs. 24, 25.

ALLOTYPE. Female, length 8.7 mm, greatest width 5.4 mm. Dorsally tan. Similar to holotype except as follows: dorsal setae larger, more conspicuous; both median and lateral clypeal tubercles reduced in size and height, a function of smaller overall size; pygidium more convex, apex more rounded.

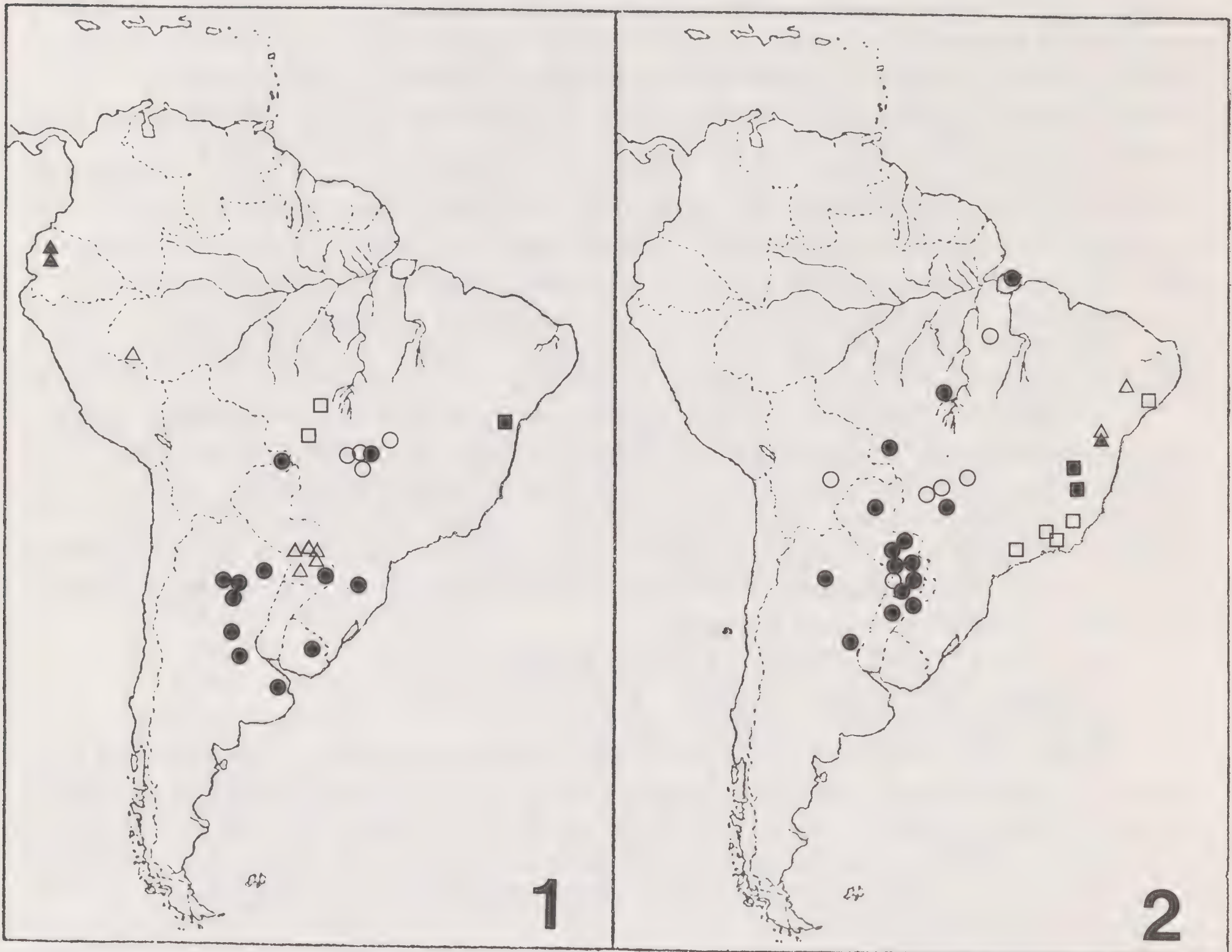
TYPE MATERIAL: Holotype, male, Brasília, Cuyabá (Berlin). Allotype, female, same data as holotype (Berlin).

PARATYPE: 1 male.

BRAZIL - Mato Grosso: 12°51'S, 51°47'W, 13.II.1968. O.W. Richards (London).

REMARKS. Seven relatively small species have an outer pronotal carina that joins the lateral margin. Four of these species have at least the elytra green or black. Three species anfractus, purpureipennis and latidorsalis are mostly tan, reddish-brown or brown with a purplish hue.

The two brown species are both related to *latidorsalis*, and since the male of *anfractus* is unknown it is difficult to ascertain which is most closely related. The three species certainly represent a complex of closely related forms that are best separated by the characters given in the key.



- ▲ = 1. *glaseri* n. sp.
 △ = 2. *arribalzagai* (Martínez)
 ● = 3. *flavithorax* (Arribalzaga)
 ○ = 4. *viridis* (Boucomont)
 ■ = 5. *anfractus* n. sp.
 □ = 6. *latidorsalis* n. sp.

- ▲ = 7. *purpureipennis* (Westwood)
 △ = 8. *anthracinus* (Klug)
 ■ = 9. *cuspinotatus* n. sp.
 □ = 10. *bidentatus* (Macleay)
 ● = 11. *sexdentatus* (Laporte)
 ○ = 12. *centromaculatus* (Felsche)

7. *Neoathyreus purpureipennis* (Westwood)

Figures 26-28, Map 2

Athyreus purpureipennis Westwood, 1848, p. 387; 1851, p. 463.

TYPE. Male, labeled "Athyreus purpureipennis Westw.; 4960" and with circular "Type" label, in London.

MALE (Holotype). Length 13.3 mm, greatest width 7.5 mm. Dorsally brown with purple tinge. Clypeus trituberculate; median tubercle slightly higher, anterior in position; oblique clypeal carina to median tubercle pronounced; posterior transverse carina distinctly elevated. Vertex between eyes flat or nearly so, evenly granulate. Pronotum (Fig. 26) with

fovea on each side behind eye deep, diameter about three times width of marginal bead; anterior pronotal margin medially with well-developed, contiguous, almost conical tubercle; posterior to tubercle midline impressed. Pronotum with inner carina on each side extremely broad, gradually rounded transversely, smooth area of carina extending to impressed midline in median third; inner carina with lateral branch extending to lateral pronotal margin just anterior to lateral fovea. Outer carina large, well-developed, parallel to outer edge of inner carina, separated from inner carina by distance equal to own width or less; short, separate, portion of outer carina present just posterior to very shallow lateral fovea, carina near fovea approximately 0.5 mm in length. Pronotum with lateral margin not indented or modified, marginal bead complete. Each elytron with at least five moderately to well-defined striae, striae punctate-setose; intervals somewhat irregular, smooth and shining. Metasternum between middle coxae flat, sparsely punctate-setose; anteriorly sharply, obtusely angulate. Fore tibia with four distinct teeth on outer margin, a vague indentation present basally behind fourth tooth. Genitalia as in figs. 27, 28.

FEMALE. Length 11.5 mm, greatest width 6.6 mm. Dorsally black with pronotum with lateral third or fourth dark brown. Similar to male except in the following respects: vertex less strongly granulate, more strongly punctate (worn); pronotum with indentation of midline obsolete; lateral branch of inner carina briefly interrupted at inner end; small segment of outer carina posterior to lateral fovea absent; dorsal setae reduced in number, probably due to abrasion.

MATERIAL EXAMINED: 1 male, 1 female.

BRAZIL - Holotype, no data. Bahia, IV.1948.

Specimens are in: London, Howden.

REMARKS. The fore tibia with four teeth on the outer margin and the extremely wide inner carina of the pronotum with its lateral branch extending to the lateral pronotal margin distinguish this species as defined here. It is possible that the much smaller female with its slight differences in the pronotal carinae represents a closely related species but, at present, I consider this unlikely.

Neoathyreus purpureipennis is related to the viridis-corinthius group which has a lateral extension, broken or complete, of the inner pronotal carina extending to the lateral pronotal margin. The wider inner carina and possibly the purplish tinge of the male elytra will separate purpureipennis from other species in the group.

8. Neoathyreus anthracinus (Klug)

Figures 29-31, Map 2

Athyreus anthracinus Klug, 1843, p. 33.

TYPE. Male (not dissected), labeled "anthracinus Klug, Bahia, Gom." [green label]; "25640; Typus" [red label]; in Berlin.

MALES. Length 9.2 to 10.0 mm, greatest width 5.8 to 6.3 mm. Dorsally black. Clypeus with oblique and transverse posterior carina strongly developed; median tubercle pronounced, anterior in position to and higher than poorly developed lateral tubercle on each side; lateral tubercle often appearing only as angulate junction of posterior and marginal carinae. Vertex between eyes feebly convex, surface granulate, with some scattered, fine, setose punctures; small area of vertex posteriorly on midline smooth,

impunctate. Pronotum (Fig. 29) with relatively large, deep fossa on each side contiguous with anterior marginal bead behind eye, fossa five or more times width of adjacent bead; pronotal margin between fossae with small, rounded tubercle at midline. Pronotum with wide, rounded inner carina, carina most widely separated from opposite carina at anterior end, carina then gradually converging with opposite one posteriorly, each carina very slightly inwardly arcuate near middle; width of carina sometimes slightly reduced near middle. Pronotal concavity Y-shaped, each arm extended to posterior edge of fossa on each side, concavity shallow, mostly smooth, a few scattered punctures on "arms" near fossae, row of punctures present along inner edge of each inner carina; inner carina with lateral branch extending to and merging with lateral margin just anterior to lateral fovea; connection of lateral branch of carina with inner carina vague to obsolete. Outer posterior carina approximately 2.0 mm in length, positioned midway between inner carina and inwardly arcuate margin of posterior pronotal angle; lateral pronotal margin below small fovea not abruptly indented, marginal bead complete. Elytron with five distinct and one or two indistinct striae between suture and umbone, distinct striae indicated by slightly irregular rows of setose punctures; slightly raised intervals largely impunctate, smooth and shining. Metasternum between middle coxae feebly convex, anterior edge at midline obtusely angulate, surface with moderate sized, shallow punctures mostly separated by one to two diameters. Fore tibia with four teeth on outer margin. Genitalia as in figs. 30, 31.

FEMALE. None seen.

MATERIAL EXAMINED: 5 males (including type).

BRAZIL - Alagoas: São Miguel dos Campos, IV. Bahia.

Specimens are in: Berlin, London, Oxford, Pittsburgh, Howden.

REMARKS. The five males seen show little variation and I suspect females will have characters similar to small males. *Neoathyreus anthracinus* can best be identified by the fairly wide, largely impunctate pronotal concavity; the relatively uniformly wide, slightly arcuate inner carina; the distinct branch of the inner carina extending to the lateral margin; the pronounced median tubercle of the clypeus (males only?) and, in non-teneral specimens, the black dorsal color. The species is probably most closely related to *purpureipennis* (Westwood).

9. *Neoathyreus cuspinotatus* n. sp.

Figures 32-34, Map 2

HOLOTYPE. Male, length 12.5 mm, greatest width 7.3 mm. Dorsally light reddish brown. Clypeus with oblique and posterior transverse carinae present, not strongly developed; median tubercle pronounced, anterior base of tubercle arising from anterior clypeal margin, face slanted posteriorly to apex of tubercle; posterior carina on each side depressed, rising slightly to small, poorly developed lateral tubercle. Vertex with median half between eyes distinctly concave; surface coarsely granulate, each granule with long tan seta at base. Pronotum (Fig. 32) with deep fossa on each side contiguous with anterior marginal bead behind eye, fossa one and one-half to two times as wide as adjacent bead; pronotal margin arcuately elevated to midline, midline starting at and posterior to margin with large, laterally compressed tubercle (see Fig. 32); tubercle approximately 1.0 mm high. Inner pronotal carina on each side arising about 1.0 mm behind fossa,

gradually elevated to slightly inflexed obtuse angle near middle, then abruptly depressed, briefly flared to inwardly arcuate posterior, posterior edge of carina approximately 0.3 to 0.4 mm from posterior pronotal margin, area near midline wider; concavity deepest between angulations, surface closely granulate-rugose and punctate, except smooth in posterior fourth behind line of angles. Outer pronotal carina obsolete, vaguely indicated by row of several larger, shining granules. Pronotum with lateral fovea shallow, small with vague secondary depression below; pronotal margin below fovea not indented, bead complete. Elytron with one or two feebly elevated, poorly defined intervals; surface of elytron closely, coarsely, irregularly punctate, each puncture with semi-erect brownish seta. Metasternum between middle coxae almost flat, anterior edge obliquely angulate, (midline obscured by glue), surface feebly punctate, each puncture with long seta. Fore tibia with five teeth on outer margin. Genitalia as in figs. 33, 34.

ALLOTYPE. Female, length 12.6 mm, greatest width 7.8 mm. Dorsally dark brown with sides of pronotum light brown. Similar to holotype except as follows: oblique clypeal carina more strongly developed; median clypeal tubercle smaller, lower; midline of pronotum anteriorly with compressed tubercle thicker, anterior edge more uniformly curved posteriorly; smooth area of posterior end of pronotal concavity extending further anteriorly and slightly wider; outer pronotal carina short, distinct between inner carina and inwardly arcuate pronotal margin anterior to posterior angle; pygidium more convex, apex more broadly rounded.

TYPE MATERIAL: Holotype, male, Brazil, Sabará-Bello Horizonte, Rio das Velhas, A.G.N. Chalmers, B.M. 1932-11 (London). Allotype, female, Brazil, Minas Gerais, Aguas Vermelhas, XII.1983, M. Alverenga (Pittsburgh).

PARATYPES: 3 males; 2, same data as allotype.

BRAZIL - 1, no other data.

Paratypes are in: Brussels, Pittsburgh, Howden.

REMARKS. This species is very close to catharinae, differing primarily in having a pronounced, laterally compressed, anterior pronotal tubercle and a differently shaped inner pronotal carina (Fig. 32). I have examined two other specimens other than the paratypes that I would refer to cuspinotatus but have excluded as paratypes because of their atypical inner pronotal carina. One specimen, a male labeled "Rio Jan. Fry" (London) is approximately the same size as the holotype but has the anterior median tubercle low, longer than high and with a sharp angle at the posterior end. The other specimen, a female, is labeled "S. America, Columbien, Cauca" (Dresden); I rather doubt the data. Both the male and female have the inner pronotal carina of approximately the same length, development and shape before and behind the small, inwardly directed obtuse angle near the middle of the carina. The shape of the carina differs from both cuspinotatus and catharinae, but is closer to the former. Either cuspinotatus exhibits considerable variation or at least two species are present. The atypical form will key to cuspinotatus in my key. Obviously more material is needed to establish the limits of variation of the various forms in this complex.

10. *Neoathyreus bidentatus* (Macleay)

Figures 35-37, Map 2

Athyreus bidentatus Macleay, 1819, p. 124; Westwood, 1851, p. 458.

Athyreus fossulatus Westwood, 1851, p. 464. NEW SYNONYMY.

TYPE. *bidentatus* Macleay, not seen, location uncertain, possibly in Macleay collection, Sydney.

TYPE. *fossulatus* Westwood. Male (? not dissected) labeled: "fossulatus Westw.; so named in Reichés collection, C.W.; Pernambuco; 30; 67.45;" and with circular "TYPE" label, in London.

MALES. Length 9.6 to 10.8 mm, greatest width 5.9 to 6.6 mm. Dorsally black with conspicuous brown setae. Clypeus trituberculate, median tubercle distinctly larger and higher than lateral tubercles; median tubercle anterior in position, anterior face rising vertically above anterior clypeal edge (large males) or slanted slightly posteriorly (smaller males); both oblique and posterior transverse clypeal carinae well developed. Vertex flat, closely granular. Pronotum (Fig. 35) on each side behind eye with small, deep fossa, diameter of fossa approximately equal to width of adjacent anterior marginal bead; anterior pronotal margin with very small tubercle or obscure swelling at midline; pronotum abruptly concave posterior to margin behind vertex, concavity elongate, deepest and smooth along midline to posterior termination marked by transverse, smooth area. Pronotal concavity delimited on each side by relatively thick carina; carina (large specimen) inwardly, obtusely rounded (not sharp angle) near midpoint of length, then feebly convergent with opposite carina to rounded posterior end just posterior to transverse smooth area; in small males carina lower, only feebly sinuate near middle. Outer pronotal carina on each side absent in most specimens, one small male (from Espírito Santo) has carina indicated by irregular line apparently formed by fusion of granules into irregular, smooth feebly raised posteriorly positioned carina. Pronotum laterally with shallow fovea, pronotal margin below not indented, marginal bead complete. Elytron with three to five feebly impressed striae, entire surface closely punctate-setose, in part rugose, raised intervals slightly less roughened; surface not mostly shining. Metasternum between middle coxae feebly convex, anterior edge obtusely angled, surface with widely separated small setose punctures; metasternal midline with faint depression or ridge. Fore tibia with four teeth on outer margin. Genitalia as in figs. 36, 37.

FEMALES. Length 9.2 to 10.6 mm, greatest width 5.4 to 6.7 mm. Similar to males except in the following respects: clypeus with median tubercle less pronounced; inner pronotal carina slightly reduced in development (large specimens) to uniform in height, straight, convergent posteriorly and with feeble, uniform, very shallow concavity lacking transverse smooth area; elytral striae in one specimen with only two striae vaguely indicated.

MATERIAL EXAMINED: 11 males, 8 females.

BRAZIL - 3, no other data; Espírito Santo: Pernambuco: Rio de Janeiro: Nova Friburgo, I; Rio de Janeiro; Petrópolis, XII. São Paulo.

Specimens are in: Brussels, Dresden, Geneva, London, Munich, Paris, Pittsburgh, São Paulo, Washington, Howden.

REMARKS. The synonymy proposed above is based primarily on Macleay's (1819) meager description which includes the following useful points: pronotum with two oblique angles (presumably refers to inner carinae), color black, fore tibia with four teeth (in observations following descriptions); and locality Brazil. The only Brazilian species seen with the

above characters is the one described by Macleay and subsequently by Westwood in 1851 under the name fossulatus. Since the above characters, if the locality is included, appear to be unique, I feel that the proposed synonymy is justified. Unfortunately the location of Macleay's type of bidentatus (and other Athyreini) remains in doubt. I have briefly examined the extensive Macleay collection in Sydney, but was unable to find any Athyreini.

There are several species of relatively small, black Neoathyreus from Brazil, but the following combination of characters will distinguish bidentatus: color black; clypeus with median tubercle near anterior edge and frequently twice the size of lateral tubercles; each inner pronotal carina with rounded, oblique, inwardly directed angulation or sinuation near middle, carina not abruptly elevated; outer pronotal carina usually absent, rarely poorly, irregularly defined; elytral surface rough, not shining; and fore tibia with four teeth on outer margin.

The shape of the inner pronotal carinae and of the pronotal concavity varies due to allometric growth. Very small specimens of both sexes lack the distinct angulation of the inner carina and in some the concavity is very shallow and completely granular. In these cases the complete marginal bead of the lateral pronotal margin and lack of or feeble development of the outer pronotal carina will usually identify the species. The male genitalia are also diagnostic.

The most similar species to bidentatus is probably violaceus (Klug) which differs from bidentatus by having: five teeth on outer margin, distinct outer carina, non-angulate inner carina, and shining elytral intervals.

11. Neoathyreus sexdentatus (Laporte)

Figures 1, 38-40, Map 2

Athyreus sexdentatus Laporte, 1840, p. 103; Westwood, 1851, p. 464.

TYPE. Female labeled: "Athyreus sexdentatus De Laporte, anim. art. v 2, p. 103, No. 9. Boards du Paraguay" all on single green label, in Oxford.

MALES. Length 8.5 to 12.1 mm, greatest width 5.2 to 7.1 mm. Dorsally uniformly tan to brown. Clypeus trituberculate, median tubercle pronounced, two to three times height of small lateral tubercle on each side and anterior in position, anterior face of tubercle rising vertically above anterior margin of clypeus; oblique carinae strongly developed, extending almost to apex of median tubercle; posterior carina extending between tubercles also strongly developed. Vertex flat to shallowly concave between eyes, surface granular and setose, sometimes less closely granular near midline. Pronotum (Fig. 38) with fossa on each side deep, diameter three to four times width of adjacent anterior marginal bead; anterior pronotal margin with small tubercle at midline; pronotum medially, posterior to anterior margin concave between inner carinae, concavity granulate except along midline. Inner pronotal carina on each side sharply, obtusely, inwardly angulate near posterior third, carina lower and inwardly arcuate posterior to angle; posterior edge of concavity frequently smooth between inner carinae; smooth area lacking in small specimens. Outer pronotal carina lacking. Lateral pronotal fovea feebly to moderately impressed, near circular; lateral pronotal margin not indented below fovea, marginal bead complete, not interrupted either medially or near posterior angle. Elytron with striae obsolete, elytral surface setose-punctate, most punctures with small anterior granule. Metasternum between middle coxae moderately

convex, midline only occasionally feebly impressed or delimited by dark line, surface punctate-setose; anterior margin rounded, distinct median angle lacking. Fore tibia frequently with six teeth on outer margin (type has six teeth), occasionally small, basal, fifth and six tooth fused giving appearance of five teeth on outer margin. Genitalia as in figs. 39, 40.

FEMALES. Length 8.4 to 12.3 mm, greatest width 5.2 to 7.4 mm. Very similar to males differing as follows: median clypeal tubercle frequently reduced in height, with anterior face slanted posteriorly, not vertical above anterior clypeal margin; inner pronotal carina(e) in very small specimens sinuate medially, distinct obtuse angle lacking.

MATERIAL EXAMINED: 80 males, 99 females.

ARGENTINA - Corrientes: Misiones: Apóstoles, XI; Gran Chaco; Río Salado; Río las Garzas [sic], Ocampo; Santa Fé: Río san Javier, Estancia la Noria, I, XII.

BRAZIL - Espírito Santo: Guyabá; Mato Grosso: Barra do Tapirapé, XI; Pôrto Velho; Rio Tapirapé, III; St. Domingos, X; Três Lagoas, IV; Pará: Soure Marajó.

PARAGUAY: Ascunción; Chaco, Río Confuso; Horqueta, III; Itapúa, Salto Tembey, X; Sa. Trinidad, XII; San Bernardino; San Pedro, Carumby, III; Sapucay, II; Villarrica.

Specimens are in: Berlin, Brussels, Chicago, Geneva, Leiden, London, Munich, New York, Paris, Pittsburgh, San Francisco, São Paulo, Tucumán, Washington, Arnaud, Glaser, Howden.

REMARKS. There has been some confusion over the application of the name sexdentatus, perhaps due in part to the variable number of teeth on the fore tibia. However, the species can usually be recognized by the obtusely, inwardly angulate inner pronotal carina on each side of the concavity, by the lack of the outer pronotal carina, by the small median tubercle on the anterior pronotal margin, by the lack of elytral striae and by the distinctive male genitalia. The most closely related species appears to be goyasensis.

12. Neoathyreus centromaculatus (Felsche)

Figures 41-44, Map 2

Athyreus centromaculatus Felsche, 1909, p. 763.

TYPE. Female, labeled "Jatahy, Goyas B.; Coll. C. Felsche, Kauf 20, 1918; centromaculatus Felsche, Goyas" handwritten on folded, red bordered label; "TYPUS"; and with museum label, in Dresden (a second smaller specimen with identical locality label is also in Dresden, but there is no evidence that it was included in Felsche's description).

MALES. Length 5.8 to 8.5 mm, greatest width 3.4 to 5.8 mm. Dorsally greyish-black to black or bicolored with head, central third or more of pronotum, and often bases of elytra black, remainder reddish brown; numerous dorsal setae pale tan to white. Clypeus with both oblique and posterior carinae strongly developed; median tubercle distinct, only slightly higher than lateral tubercle on each side, posterior carina between tubercles downwardly arcuate between tubercles. Vertex flat to very slightly concave between eyes; surface granulate-setose, granulations closer on small specimens. Pronotum (Figs. 41, 42) with small fossa on each side behind eye contiguous with anterior marginal bead, fossa two to three times width of adjacent bead; anterior margin at midline with pronounced conical tubercle situated just posterior to marginal bead and with anterior base

merging with bead. Pronotum with inner carina on each side arising at or behind level of lateral foveae; carina somewhat variable in length, proportionately shorter in larger males, carina moderately to feebly bowed inwardly between ends, carina measuring 0.2 to 0.3 mm in width (wide for size of species), uniformly elevated and sharply delimited from surrounding granulate surface; surface between inner carinae concave for total area between carina, wider anteriorly; surface of concavity granulate with transverse smooth band extending between carinae, position and width of band varying with size, being reduced in width and more posterior in position in small specimens. Outer pronotal carina absent; lateral fovea on each side very small, shallow; pronotal margin below fovea not indented, bead not interrupted. Elytron with few faint depressions at base, no striae or intervals extending onto disc; elytral surface closely, coarsely punctate, surface between irregular, shining; most punctures each with semi erect seta. Metasternum between middle coxae flat to feebly convex, midline faintly indicated or not, anterior edge at midline obtusely angulate; surface with widely separated coarse punctures, each with long whitish seta. Fore tibia with six teeth on outer margin, basal tooth often minute (probably not evident in abraded specimens). Genitalia as in figs. 43, 44.

FEMALES. Length 5.8 to 7.1 mm, greatest width 3.7 to 4.6 mm. In color, punctures, and shape of pronotal carinae females as variable as males; differing from males as follows: clypeus with median tubercle slightly reduced in height and with anterior face more slanted, tubercle more posterior in position; lateral tubercles not differing from those of males. Pygidium more convex, apex more rounded.

MATERIAL EXAMINED: 6 males, 3 females.

BOLIVIA - Santa Cruz: Buena Vista.

BRAZIL - Goiás: Jataí (= Jatahy); Mineiros; Rio Verde; Trindade; Pará.

PARAGUAY - San Bernardino.

Specimens are in: Berlin, Paris, Pittsburgh, Howden.

REMARKS. As defined here centromaculatus may represent a complex of closely related forms. The relatively few specimens I have seen vary considerably, not only in size and color, but nearly every specimen seen has slightly differently shaped inner pronotal carinae. However the variation noted cannot be easily correlated with different localities or habitats. The few specimens seen from Jatai (type locality) varied from bicolored to entirely black; the largest and smallest specimens were also from that locality and the greatest pronotal variation also occurred there. Before naming any of the different "morphs" I would want to have a good series bearing accurate data from a number of localities.

The species can be recognized by its relatively small size, black or sharply brown and black dorsal color, fore tibia with six teeth, and its pronotal characters (Figs. 41, 42).

13. Neoathyreus peckorum n. sp.

Figures 45-47, Map 3

HOLOTYPE. Male, length 9.6 mm, greatest width 6.6 mm. Dorsally reddish brown. Clypeus with oblique and posterior carinae complete, moderately developed; oblique carina on each side fusing with opposite below anterior apex of median tubercle; median tubercle approximately twice height

of lateral tubercle on each side; apex of median tubercle round, somewhat triangular in dorsal view; lateral tubercles feebly developed. Vertex feebly concave between eyes, surface finely granulate-rugose, most granules each with erect tan seta at base. Pronotum (Fig. 45) with relatively deep fossa on each side contiguous with anterior marginal bead behind eye; fossa three to four times width of adjacent bead; anterior pronotal margin between fossae elevated to midline, midline with large, erect, acutely pointed tubercle, anterior base of tubercle merging with anterior marginal bead. Inner pronotal carinae complex, carina on each side arising approximately 0.4 mm behind fossa, carina upwardly arcuate at middle (in lateral view), parallel with opposite carina (in dorsal view) to posterior third, then abruptly inwardly arcuate to sinuate, inner margin of carina bending anteriorly and merging with opposite carina to form acute, anteriorly directed tubercle, midline with low ridge for 1.0 mm anterior and below tubercle; posterior portion of inner carina on each side with posterior extension (as typical for many *Neoathyreus*) terminating about 0.4 mm from midline and 0.6 mm from posterior pronotal margin. Pronotal concavity slightly elongate, midline impressed anteriorly behind anterior acute tubercle; surface of concavity granulate-punctate, gradually with fewer, more widely spaced granules, posterior declivous portion smooth. Outer pronotal carina on each side thick, feebly arcuate, approximately 1.0 mm long, positioned midway between posterior lateral pronotal margin and inner carina. Pronotum with lateral fovea obsolete, area very feebly concave (unusual for genus), pronotal margin below not indented, marginal bead complete; median pronotal angle broadly rounded. Elytron with striae obsolete, surface closely, coarsely punctate, each puncture with semi-erect seta; surface between punctures shining. Metasternum between middle coxae feebly convex, midline feebly, narrowly indented, anterior edge at midline broadly, obtusely angulate, sharp projection lacking; surface of metasternum shallowly punctate, each puncture with long, semi-erect seta. Fore tibia with six teeth on outer margin. Genitalia as in figs. 46, 47.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Colombia, 33 km E. Villavicencio, 2-4.III.1972, S. & J. Peck, in forest (Howden).

REMARKS. This species has relatively unique pronotal characters, the acute tubercle at the middle of the anterior margin and the acute tubercle at the posterior median end of the concavity are sufficient to recognize the species. The species probably belongs to the *lanuginous* complex.

The species is named in honour of my colleagues, Stewart and Jarmila Peck, both of whom have contributed greatly to this study and have, over the years, turned up many new and interesting Scarabaeidae.

14. *Neoathyreus corniculatus* (Felsche)

Figures 48-50, Map 3

Athyreus corniculatus Felsche, 1909, p. 762.

TYPE. Female, labeled: "Venezuela, Mérida; Coll. C. Felsche, Kauf 20, 1918; *corniculatus* Felsche, Venezuela [handwritten on folded, red bordered label]; TYPUS;" and with museum label, in Dresden.

MALES. Length 12.6 to 13.8 mm, greatest width 7.3 to 8.0 mm. Dorsally brown to dark brown with sides of pronotum frequently lighter in color. Clypeus with both oblique and posterior carinae present, posterior carina on each side of median tubercle depressed and extending obliquely posteriorly to pronounced lateral tubercle; median tubercle distinctly anterior to lateral tubercles, anterior face vertical to slanted, slanted posteriorly above clypeal margin. Vertex between eyes with concave area, surface of vertex closely granulate, median depression frequently only finely, sparsely granulate. Pronotum (Fig. 48) with small fossa on each side behind eye adjacent to anterior marginal bead, diameter of fossa three or four times width of adjacent marginal bead; pronotal bead at midline very feebly thickened, not widened and elevated (see lobus). Pronotum with inner carina on each side more sharply delimited along outer edge, carina anteriorly arising approximately 1.0 mm posterior to fossa, most distinctly elevated in posterior half, elevated portion evenly, inwardly arcuate to approximately 0.5 mm from midline; upright, slightly laterally compressed knob (Fig. 48) present on midline between lateral carinae approximately 1.5 mm before posterior pronotal margin; concavity between carina broad, sides gradually sloping, surface in anterior half moderately to closely granulate; granules becoming gradually smaller, more widely spaced to a smooth non-granulate, feebly punctate area on either side of knob, the poorly delimited smooth area forming inner portion of inner carinae. Outer pronotal carina on each side absent or feebly indicated by presence of elongate, non-granulate area midway between arcuate posterior pronotal angle and inner carina; lateral fovea small, pronotal margin below feebly indented, marginal bead occasionally briefly interrupted. Elytron with three to five very feebly elevated intervals, surface of elytron closely, irregularly granulate and punctate-setose. Mesosternum between middle coxae feebly convex, anterior margin at midline obtusely angulate; surface slightly alutaceous, with well spaced setose punctures, most punctures with minute, raised granulation at anterior edge. Fore tibia with five or six teeth on outer margin. Genitalia with apex of capsule narrowly rounded, not reflexed, densely setose. Genitalia as in figs. 49, 50.

FEMALES. Length 12.0 to 12.8 mm, greatest width 7.1 to 7.9 mm. Differs only slightly from males: clypeal tubercles smaller, lower; pronotum with flattened, smooth area along inner edge of inner carinae reduced in width (may be more related to size than sex); pygidium more convex, apex more broadly rounded.

MATERIAL EXAMINED: 2 males, 5 females.

VENEZUELA - Carabobo: Borburata, 600m, IV. Caracas. Miranda; Petaguiro, V: San Antonio.

Specimens are in: Berlin, Geneva, Maracay, Howden.

REMARKS. It is interesting that the range of corniculatus seems to be limited to northern South America, while its sibling, lobus, occurs in Argentina. The two species are externally very similar, differing primarily in their pronotal characters; however there are subtle differences as well, for example, the mesosternum of lobus has larger, more closely spaced punctures lacking distinct anterior granules that are usually present in corniculatus. Habitat data are lacking for corniculatus but I suspect the habitats are roughly similar to those of lobus.

15. *Neoathyreus lobus* n. sp.

Figures 51-53, Map 3

HOLOTYPE. Male, length 13.4 mm, greatest width 8.1 mm. Dorsally head and pronotum light brown with sides of pronotum tan, elytra darker brown. Clypeus with both oblique and posterior carina well developed, posterior carina on each side of median tubercle slightly depressed and extending obliquely posteriorly to lateral tubercle; median tubercle distinctly anterior in position to lateral tubercles; all tubercles well developed. Vertex between eyes feebly concave, surface densely granulate. Pronotum (Fig. 51) with minute fossa on each side behind eye adjacent to margin, fossa only slightly larger in diameter than adjacent granules; anterior pronotal marginal bead at midline elevated and expanded into a posteriorly directed obtuse angulation of the posterior edge of bead. Pronotum with inner carina on each side arising about 0.8 mm posterior to fossa, carina nearly straight in anterior half then abruptly, inwardly arcuate and widened in posterior half; outer edge of carina elevated, inner margin less elevated above surface but delimited by sharp, crenulate edge adjacent to closely granulate area of concavity; concavity gradual, posterior midline 1.8 mm before posterior margin with upright, nearly circular knob with base anteriorly and laterally closely granulate-punctate. Outer carina on each side poorly developed, represented by short, feebly elevated ridge above inwardly arcuate posterior pronotal angle, ridge closer to inner carina than to margin; lateral pronotal margin feebly indented below small lateral fovea, marginal bead complete, not reduced or broken. Elytron with one or two very feebly depressed striae near suture, surface almost uniformly, roughly punctate, most punctures each with erect, posteriorly slanted tan seta. Mesosternum between middle coxae slightly convex, midline faintly impressed, anterior edge at midline obtusely angulate; surface with moderate sized punctures separated by approximately two diameters, most punctures each with long tan seta. Genital capsule with apex broadly rounded, setose. Genitalia as in figs. 52, 53; slender cylindrical projection on each side nearly twice as long as in *corniculatus*.

ALLOTYPE. Female, length 13.1 mm, greatest width 7.3 mm. Similar to holotype except: darker with head, pronotum, and elytra brown, sides of pronotum light reddish-brown; pygidium more convex, apex more broadly rounded.

TYPE MATERIAL: Holotype, male, Argentina, Catamarca, La Viña, 22-25.II.1979, R. Golbach (Tucumán). Allotype, female, same data as holotype (Tucumán).

PARATYPES: 10 males, 22 females.

ARGENTINA - 5, same data as holotype. 1, no other data, A.E. Bottche. Northern Argentina, 1907-205BM. Jujuy: 6 km W. Yuto, INTA, 13-14.II.1982, H. & A. Howden. Tucumán: 450 m, 21.I.1904, 3.V.1926, XI-XII.1944, R. Golbach; Farallon Blanco, 7-8.II.1961, R. Golbach; Horco Molle, 15.I.1961, L. Stange, 18.I.1966, H. & M. Townes; Tafí Dist., X. 1945; Tafí Viejo, X.1945, A. Brizuela; Tucumán City, I.1952, P. Wygodzinsky; Villa Nougues, III.1939, I.1957, F. Monros, 13.I.1966, L. Stange, 13-17.I.1966, H. & M. Townes. Salta: Prov. 1905, Steinbach; Cerrillos, INTA, 9.II.1982, H. & A. Howden; 20 km N. La Caldera, El Ucumar, 780 m, 31.I.1982, H. & A. Howden; Viñaco, 15 km S. El Carril, 12.II.1982, H. & A. Howden.

BOLIVIA - San Antonio.

Paratypes are in: Berlin, London, Paris, Tucumán, Washington, Howden, Martínez.

REMARKS. Size ranges from 11.4 to 13.7 mm in length and from 6.7 to 8.9 mm in greatest width. The majority of specimens resemble the allotype in coloration, but in major characters there are no noteworthy variations. Most of the specimens personally collected were taken at light in areas of dense thorn scrub or at Yuto in Jujuy, near a patch of broadleaf evergreen forest. One specimen from Cerrillos in Salta Prov. was caught in a flight interception trap set in long grass in a stand of Prosopis sp. (mesquite trees). Specimens taken at light flew in shortly after sunset. The species is closely related to corniculatus from Venezuela; characters separating the two species are given under corniculatus and in the key.

16. Neoathyreus reichii (Westwood)

Figures 54-57, Map 3

Athyreus reichii Westwood, 1851, p. 465.

TYPE. Female (not dissected) labeled: "Athyreus reichii Westw. NOV. GRANADA; 11; 67.45; 33;" and with circular "TYPE" label; in London.

MALE. Length 11.2 mm, greatest width 7.2 mm. Dorsally tan to light brown (slightly teneral). Clypeus trituberculate; median tubercle lower, smaller than lateral tubercle on each side; median tubercle slightly anterior in position; oblique and posterior carinae present, complete. Vertex abruptly concave between eyes, concavity deep, nearly circular, surface smooth and shining; vertex on each side of concavity closely punctate-setose. Pronotum (Fig. 54) with fossa on each side near anterior margin behind eye deep, diameter about three times width of anterior marginal bead; anterior pronotal margin lacking medium tubercle; midline approximately 1.0 mm posterior to anterior margin with large, laterally compressed, acutely angled horn or large tubercle; pronotum posterior to horn concave between inner carinae. Inner pronotal carina on each side extending from posterior indentation of fossa in arcuate curve to feeble obtuse angulation of carina at posterior fourth, carina then distinctly less elevated, bending sharply inward and inwardly smooth and flat to indented midline; posterior end of carina 0.4 to 0.5 mm anterior to posterior margin of pronotum. Outer pronotal carina approximately 1.0 mm long, straight, slightly closer to inner carina than to margin near posterior angle. Lateral pronotal fovea consisting of elongate depression, deepest at either end; lateral pronotal margin below fovea indented, marginal bead broken. Elytron with four or five feebly impressed striae; elytral surface irregularly punctate-setose, punctures more numerous on each side or in striae; setae semi-erect, dark brown. Metasternum between middle coxae very feebly convex, midline narrowly impressed, impunctate; surface otherwise with numerous, evenly spaced setose punctures; anterior edge very obtusely angulate. Fore tibia with five teeth on outer margin. Genitalia as in figs. 56, 57.

FEMALE (holotype). Length 9.7 mm, greatest width 5.7 mm. Similar to male except in the following respects: dorsally dark brown with clypeus, frons, and lateral thirds of pronotum reddish brown; median clypeal horn distinctly anterior in position, well-developed, as elevated as lateral tubercles; concavity of vertex smaller, vertex laterally granular, less setose; pronotum (Fig. 55) with median horn one-third size of male, concavity very shallow; posterior, transverse portion of inner carina only feebly indicated;

lateral carina slightly shorter; many setae on pronotum and elytra absent, loss seemingly due to abrasion.

MATERIAL EXAMINED: 3 males, 1 female.

COLOMBIA - 1, no other data. 1, Nova Grenada = Colombia, Panama, and Venezuela (holotype).

VENEZUELA - 2, Tachira, cr. San Cristóbal.

Specimens are in: Maracay, Paris, Howden.

REMARKS. *Neoathyreus reichii* is related to the *centralis* group of species, all having a pronounced tubercle on the pronotal midline distinctly posterior to the anterior margin. The indented lateral pronotal margin with the broken marginal bead will separate *reichii* from *centralis* and related species. These characters plus the five teeth on the fore tibia, central pronotal tubercle and odd shape of the inner pronotal carina will distinguish *reichii* from any other *Neoathyreus*. Most of the differences noted between the male and female of *reichii* are probably due to allometric growth caused by the difference in body size.

17. *Neoathyreus pholas* (Westwood)

Figures 58-60, Map 3

Athyreus pholas Westwood, 1848, p. 387; 1851, p. 462; Harold, 1880, p. 44. *Athyreus vulpinus* Harold, 1880, p. 4. NEW SYNONYMY.

Lectotype of *pholas* Westwood here designated: male, labeled 'pholas Buq.; Type, Westwood, Ann. Nat. Hist. p. 387, Coll. Hope Oxon.; Type, col: 497 $\frac{1}{2}$, *Athyreus pholas* Westw., Hope Dept. Oxford'; and with my lectotype label; in Oxford. Paralectotype, male with same 'type' labels as lectotype except '497 2/2'; in Oxford.

TYPE. *vulpinus* Harold labeled: 'La Mesa; vulpinus Harold; green disc; Ex Musaeo E. Steinheil; Museum Paris ex coll. R. Oberthür, 1952'; in Paris.

MALES. Length 10.5 to 13.5 mm, greatest width 6.1 to 8.3 mm. Dorsally uniformly brown. Clypeus bituberculate, median tubercle absent, lateral tubercles strongly elevated, narrowly separated, carinate between and with posterior carina on each side arcuately extended posteriorly to inner anterior edge of gena; anterior face of clypeus lacking distinct carina, surface smooth or slightly roughened. Vertex concave between eyes, center of concavity smooth, sides granulate. Pronotum (Fig. 58) with deep fossa on each side contiguous with anterior marginal bead behind eye, diameter of fossa equal to two or three times width of adjacent marginal bead; anterior pronotal margin lacking median tubercle, but with large, laterally compressed tubercle on midline approximately 0.8 to 1.0 mm posterior to margin, tubercle occasionally connected anteriorly to margin by poorly delimited, narrow ridge or carina; posterior to tubercle pronotum moderately to deeply concave, concavity becoming shallow posteriorly. Pronotal carinae delimiting concavity unusual (Fig. 58). Inner carina on each side arising anteriorly in line with tubercle, then elevated and inwardly arcuate to abrupt, acute angle, posterior to angle inner carina poorly delimited or absent; posterior end of concavity delimited by bow-shaped outer carina joining one from opposite side at midline, outer end of each carina positioned midway between angle of inner carina and margin just anterior to posterior pronotal angle; inner end of outer carina curving anteriorly to midline, adjacent portion of concavity mostly smooth and impunctate, bottom of concavity punctate.

Lateral portions of pronotum granulate, fovea on each side elongate, narrow, shallow; pronotal margin below fovea very slightly indented, bead not broken, complete. Elytron basally with three or four striae very faintly indicated; surface closely punctate-setose. Metasternum between middle coxae feebly convex, anterior edge broadly, obtusely angulate; convex surface with well separated, shallow setose punctures. Fore tibia with five teeth on outer margin. Genitalia as in figs. 59, 60.

FEMALES. Length 11.3 to 12.5 mm, greatest width 7.1 to 7.8 mm. Similar to male except for the following obvious differences: clypeus trituberculate; median tubercle slightly lower and anterior in position to lateral tubercles near lateral margins; posterior carina connecting clypeal tubercles moderate in development; anterior face of clypeus on each side with feebly oblique carina almost meeting carina extending anteriorly from median tubercle; anterior face of clypeus strongly rugose in unworn specimen.

MATERIAL EXAMINED: 7 males, 9 females.

COLOMBIA - Bogotá; Gigante-Huila; Ibaqué; La Mesa; Muzo, X. One specimen almost certainly mislabeled "Brazil".

Specimens are in: Berlin, Brussels, Dresden, Oxford, London, Maracay, Munich, Paris, Howden.

REMARKS. Neoathyreus pholas is probably most closely related to the Mexican-Central American fissicornis Harold. The sharply pointed median pronotal tubercle and larger size will separate pholas from that species and the odd position of the inner and outer pronotal carinae (Fig. 58) coupled with the range of pholas (Colombia) will separate it from any South American species.

Nothing is known of the habits and few recently collected specimens have been seen.

18. Neoathyreus centralis (Westwood)

Figures 61-65, Map 4

Athyreus centralis Westwood, 1848, p. 387; 1851, p. 463.

TYPE. Male (? not dissected, very teneral, poor condition), labeled "Athyreus centralis W., Magdalena, . . . [line illegible], . . . Ibaqué; Columbia [circular label], 46-20 [reverse side];" and with circular "Type" label, in London.

MALES. Length 12.9 to 13.1 mm, greatest width 7.3 to 7.5 mm. Dorsally uniformly tan or brown. Clypeus trituberculate; median tubercle twice height of lateral tubercles, distinctly anterior in position, anterior base rising from anterior clypeal edge; lateral tubercle on each side elongate, slightly inclined laterally above antennal insertion; clypeus with oblique carina on each side and posterior carina between tubercles relatively feebly developed. Vertex between line of genae concave, concavity circular in shape, center smooth, surrounding area rugose or closely granulate. Pronotum (Fig. 61) with fossa on each side behind eye very small, shallow, diameter of fossa less than width of adjacent anterior marginal bead; anterior pronotal margin lacking median tubercle. Pronotum in center of disc with elongate, laterally compressed keel approximately 0.5 to 0.6 mm in height and 1.5 or 1.6 mm long; anterior margin slanted posteriorly and rounded to flattened dorsal edge; keel posteriorly abruptly rounded, vertical or slightly undercut; pronotum on each side of keel feebly, elongately concave,

posterior to keel with shallow, sparsely punctate, transverse concavity; concavities on each side delimited by inner carina, anterior end of carina beginning at anterior third of pronotal length, low, slightly arcuate, feebly convergent to anterior outer edge of transverse concavity, carina highest at that point, then obtusely angled downward, carina then slightly to distinctly reduced in width, straight to feebly inwardly curved at posterior end 0.1 to 0.2 mm anterior to posterior pronotal margin. Outer pronotal carina 1.1 to 1.5 mm in length, arcuate, slender; positioned midway between inner carina and inwardly arcuate pronotal margin just anterior to posterior angle; arcuate portion of margin with adjacent elongate groove, surface of groove smooth, deepest adjacent to posterior angle. Lateral pronotal fovea on each side very shallow, small; lateral pronotal margin below fovea very slightly indented, marginal bead complete. Elytron basally with two or three striae feebly indicated; surface of elytron rugose or granulate and punctate, most punctures each with semi-erect seta. Metasternum between middle coxae feebly convex, anterior edge obtusely angulate; metasternal surface with evenly scattered, small, setose punctures. Fore tibia with five teeth on outer margin. Genitalia as in figs. 64, 65.

FEMALE. Length 12.1 mm, greatest width 7.0 mm. Similar to males except in the following respects: clypeus with median tubercle lower, slightly smaller; oblique clypeal carina more strongly developed; posterior transverse clypeal carina indistinct; concavity of vertex with two-thirds reduction in diameter; pronotum (Figs. 62, 63) with keel, inner and outer carinae slightly lower (probably due to somewhat smaller size); pronotal surface more completely granulate; entire dorsum more conspicuously setose.

MATERIAL EXAMINED: 3 males, 3 females.

COLUMBIA - Gigante-Huila, I. Magdalena (holotype): Tolima, Cañón del M[agdalena]; 1500 m, X.

PERU - Huánuco Dept., Cordillera Azul, 39 km NE Tingo María, 1700 m, I; Santa Ana.

Specimens are in: Berlin, London, Maracay, Howden.

REMARKS. Only a few species of *Neoathyreus* have a distinct, laterally compressed keel on the pronotal midline near the center of the disc. Only *centralis* has the keel distinctly longer than high. This character coupled with the characters of the head, complete marginal bead of the lateral pronotal margin and the five teeth on the outer edge of the fore tibia should be sufficient to distinguish *centralis*. The most closely related species is *lingi* from Ecuador.

19. *Neoathyreus lingi* n. sp.

Figures 66-68, Map 4

HOLOTYPE. Male, length 10.3 mm, greatest width 6.3 mm. Dorsally very dark brown with sides of pronotum reddish-brown. Clypeus with oblique carina on each side distinct, posterior carina feebly indicated; median tubercle strongly developed, anterior in position, anterior face almost vertical, lateral tubercle on each side moderate in size; surface between lateral and median tubercles depressed. Vertex between eyes with distinct, nearly circular depression medially between eyes, surface of concavity smooth or nearly so, remainder of vertex closely granulate, each granulation with long, erect, tan seta at base. Pronotum (similar to female, Fig. 66) with relatively small fossa on each side contiguous with anterior marginal

bead behind eye; width of fossa approximately equal to width of adjacent bead; anterior pronotal margin between fossae only gradually elevated to midline, bead thickened at midline, marginal tubercle lacking. Pronotum centrally with laterally compressed upright lobe on midline, pronotum shallowly concave on each side and anterior to lobe; inner pronotal carina on each side of lobe evenly arcuate in dorsal view, most distinctly elevated adjacent to lobe becoming lower and slightly narrower posteriorly; surface of concavity between inner carinae punctate-granulate, most punctures each with upright seta. Outer pronotal carina on each side present only posteriorly; slender, feebly elevated, slightly closer in position to inner carina than to lateral pronotal margin just anterior to posterior angle. Lateral pronotal fovea on each side feebly indicated by irregular elongate depression; pronotal margin below fovea not indented, marginal bead complete, not reduced. Elytron with three or four feebly depressed striae; striae and surface between irregular and with scattered coarse punctures, each with almost erect, long, slender seta; surface between punctures dull. Metasternum between middle coxae feebly convex, anterior edge obliquely angulate, apex of angle with sharp tubercle; surface of metasternum with scattered shallow punctures, some punctures each with long seta (others lacking setae due to abrasion). Fore tibia with five teeth on outer margin. Genitalia as in figs. 67, 68.

ALLOTYPE. Female, length 13.2 mm, greatest width 7.4 mm. Similar to holotype except in the following respects: vertex more deeply concave; pronotum with median central lobe more strongly developed (Fig. 66); pronotal concavity slightly more pronounced; lateral pronotal margin below fovea very slightly indented; elytral surface more roughened; pygidium more convex, apex more rounded.

TYPE MATERIAL: Holotype, male, O. Ecuador, Macas, E. Feyer S. (Washington).

Allotype, female, Ecuador, Napo Prov., 2000 m, 7 km S. Baeza, 21.II.1979, H. & A. Howden, [flying to black light at dusk](Howden).

PARATYPES: 4 females.

ECUADOR - 3, same data as allotype, except 1 collected 22.II. and 1 on 25.II.1975. 1, Napo, San Francisco de Barja [sic], 15.V.1975, at black light, Spangler, Gurney, Langley, and Cohen.

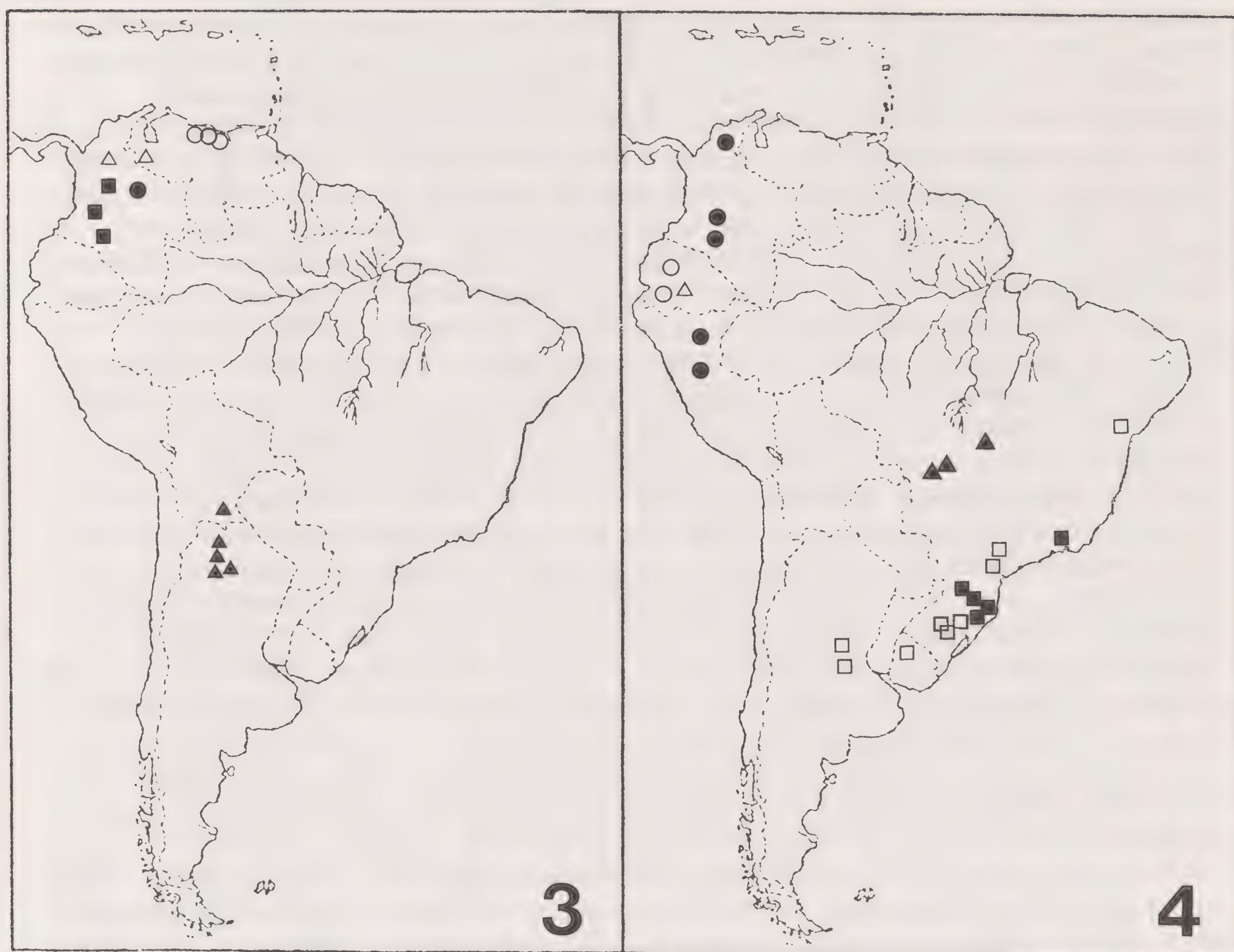
Paratypes are in: Washington, Howden.

REMARKS. The holotype represents the smallest specimen seen and the allotype the largest. One paratype has six teeth on the outer margin of the fore tibia. In other respects the series shows little variation.

Neoathyreus lingi is most closely related to reichii and centralis, possibly slightly less so to the former. Both reichii and centralis have the pronotum uniform in color. In reichii the pronotal concavity is posterior to the upright lobe on the midline. In centralis the central protrusion is keel-like and often abruptly declivous near the posterior end, the inner carina on each side is angulate near the posterior end.

The area in which lingi was personally collected was partly cut over wet mountain forest with open grassy areas. All specimens came to a 15 watt black light at dusk.

The species is named in honour of Mr. L.E.C. Ling who is not only responsible for the excellent S.E.M. pictures of Neoathyreus but who has also collected scarabs with me in Ecuador in localities in which some of the Neoathyreus have been taken.



- = 13. peckorum n. sp.
- = 14. corniculatus (Felsche)
- ▲ = 15. lobus n. sp.
- △ = 16. reichii (Westwood)
- = 17. pholas (Westwood)

- = 18. centralis (Westwood)
- = 19. lingi n. sp.
- ▲ = 20. goyasensis (Boucomont)
- △ = 21. boosi n. sp.
- = 22. catharinae (Bates)
- = 23. corinthius (Klug)

20. Neoathyreus goyasensis (Boucomont)

Figures 69-71, Map 4

Athyreus goyasensis Boucomont, 1902b, p. 585.

TYPE. Male, labeled "Athyreus goyasensis B. type; Jatahy, Prov. Goyas, Brésil; Typus [red label]; Museum Paris, 1938, Coll. A. Boucomont"; in Paris.

MALES. Length 10.0 to 10.6 mm, greatest width 6.6 to 6.8 mm. Dorsally reddish brown. Clypeus with both oblique and posterior carinae strongly developed; median tubercle pronounced, slightly longer than wide at apex and approximately twice height of lateral tubercle on each side, posterior carina on each side depressed below level of tubercles. Vertex between eyes flat to very feebly convex, surface granulate, posterior base of some granulations each with semi-erect, long, tan seta. Pronotum (Fig. 69) with moderate sized fossa on each side contiguous with marginal bead posterior to eye; fossa three or four times width of adjacent bead; pronotal margin between fossae strongly elevated to small tubercle at midline,

tubercle and margin forming obtuse angulation. Pronotum with inner carina on each side arising approximately 1.0 mm behind fossa, carina abruptly elevated to acute angulation, angulation of carina nearly vertical, not directed inward; carina at posterior base of angulation briefly very feeble or absent then becoming distinct to elevated posterior end about 0.4 to 0.5 mm before posterior pronotal margin; posterior portion of carina behind angulation nearly parallel to and closer to impressed midline; broad concavity present primarily between anterior angulate portions of carinae; midline and band on each side near posterior of concavity smooth, remainder of surface granulate-punctate, most punctures each with tan seta. Outer pronotal carina on each side, midway between posterior base of angulation of inner carina and posterior marginal angle, very short, 0.4 to 0.6 mm in length, feebly developed, occasionally indistinct. Pronotum on each side with fovea small, circular; lateral pronotal margin below fovea not indented, marginal bead not interrupted. Elytron lacking distinct striae or elevated intervals; surface closely punctate-granulate, each puncture with semi-erect tan seta. Metasternum between middle coxae very feebly convex, midline not impressed, anterior edge at midline with pronounced obtuse angle; metasternal surface punctate-granulate, puncture at base of granule shallow, bearing long tan seta. Fore tibia with six teeth on outer margin, basal tooth minute. Genital capsule broadly rounded at base of short sharply angulate apex. Genitalia as in figs. 70, 71.

FEMALE. Length 9.5 mm, greatest width 6.0 mm. Differing from males as follows: clypeus with median tubercle reduced in height and more posterior in position, oblique carina on each side merging anterior to median tubercle, a single median carina extending from junction posteriorly to median tubercle; lateral tubercles less pronounced, only slightly lower than median tubercle; vertex more closely granulate (a function of smaller size?); pronotum more coarsely granulate; inner pronotal carina more elongate, anterior angulation feebly elevated, obtuse; inner carina not interrupted posterior to angulation; pronotal concavity less pronounced, entirely granulate except indented portion of midline; outer pronotal carina on each side obsolete; pygidium more convex, apex more rounded.

MATERIAL EXAMINED: 3 males, 1 female.

BRAZIL - Goiás: Jataí (= Jatahy); Monjolinho; Rio Verde.

Specimens are in: Dresden, Paris, Howden.

REMARKS. The variation noted between males and females may be, at least in part, influenced by size. From the material at hand, the degree of influence that size differences have on various characters is impossible to determine. Large males can be recognized by the sharply angulate anterior half of the inner pronotal carina, by the posterior base of the angulation having the carina obsolete, reappearing posteriorly, nearly parallel and closer to midline. The feebly developed lateral pronotal carina is also useful.

21. Neothyreus boosi n. sp.

Figure 72, Map 4

HOLOTYPE. Female, length 17.4 mm, greatest width 9.4 mm. Dorsally dark brown with lateral fourth of pronotum on each side reddish brown. Clypeus with both oblique and posterior carinae present but weakly developed, strongly depressed between large tubercles; median tubercle

slanted anteriorly over anterior edge of clypeus; lateral tubercle on each side positioned in line with antennal insertion, apex of tubercle separated from lateral margin by approximately 0.5 mm; tubercle upright and transverse; posterior carina between tubercles similar to inverted "Y", the base formed by elevated midline posterior to median tubercle. Vertex between eyes broadly concave in central three-fourths, surface granulate to rugose-punctate; most punctures each with erect, tan seta. Pronotum (Fig. 72) with cone shaped fossa on each side near anterior marginal bead behind eye, fossa three to four times width of adjacent bead; margin between fossae gradually elevated to large erect, cylindrical, pointed tubercle on midline posterior to and contiguous with marginal bead. Inner pronotal carina viewed from above having the outline of a figure "8", larger anterior half with carina anteriorly obsolete, indicated by declivous sides of concavity; center of figure marked by acutely angled, transversely, inwardly directed spur of each carina; carina posterior to angle curving inwardly to midline, posterior two thirds flattened, posterior edge similar to shape described for *lyriferus*. Pronotal concavity most pronounced and deepest anterior to acute angles of inner carinae, surface of concavity with irregularly spaced small punctures. Outer carina on each side divided into two parts; anterior portion consists of feebly developed, irregular extension of inner carina extending to area immediately anterior to lateral fovea, carina not noticeably elevated, only evident as irregular smooth areas; posterior portion of outer carina moderately elevated, feebly arcuate, positioned midway between carina and indented pronotal margin at posterior angle, carina approximately 2.2 mm long. Pronotum laterally with fovea small, edge of pronotum below fovea not indented, marginal bead complete. Left elytron with three feebly elevated intervals between suture and umbone, surface closely, irregularly punctate, most punctures each with semi-erect tan or black seta (right elytron missing). Metasternum between middle coxae flat, midline slightly elevated, anterior edge with sharp, obtuse angle at midline; surface of metasternum with numerous shallow punctures, each with long semi-erect tan seta. Fore tibia with five distinct teeth on outer margin, sixth basal tooth vaguely indicated on left tibia (absence due to abrasion?).

MALE. Unknown.

TYPE MATERIAL: Holotype, female, S.E. Ecuador, Morona Santiago, Logrono [sic], 1075 m. 17.VI.84 (Howden).

REMARKS. The three strongly developed clypeal tubercles and the transverse, inwardly directed acute angles at the middle of the inner pronotal carinae will distinguish *boosi* from the closely related *lyriferus* or *accinctus*. In the key *boosi* stands beside *catharinae* but is not closely related.

Neoathyreus boosi is named for Julius Boos who has collected and sent to me a number of interesting and rare Ecuadorian Scarabaeidae including the above and several other *Neoathyreus*.

22. *Neoathyreus catharinae* (Bates)

Figures 73-75, Map 4

Athyreus catharinae Bates 1887, p. 110.

LECTOTYPE here designated. Male, labeled "catharina Bates, S. Catharina Brazil; Ex Musaeo H.W. Bates 1892; Museum Paris ex Coll. R. Oberthür, 1952"; and with "Type" label; in Paris.

MALES. Length 11.4 to 13.1 mm, greatest width 7.1 to 7.9 mm. Dorsally dark brown (non-teneral specimens) with clypeus, lateral third of pronotum, and often each elytral umbone tan or reddish brown. Clypeus with both oblique and posterior carinae strongly developed; median tubercle anterior in position with face rising almost vertically 0.8 to 1.1 mm above anterior clypeal margin, tubercle slender, rounded apex slightly longer than wide; lateral tubercle on each side low, feebly developed. Vertex slightly, irregularly convex, flat at base of frons, surface rugose with numerous erect, tan setae. Pronotum (Fig. 73) with small fossa on each side contiguous with anterior marginal bead behind eye, fossa approximately twice width of adjacent bead; pronotal margin convex between fossae, midline frequently with low keel or extension of bead extending posteriorly approximately 0.5 mm; neither keel nor midline distinctly tuberculate. Inner pronotal carina on each side becoming evident about 1.0 mm behind fossa, carina slanted upward and inward, terminating about middle of pronotum in acute, elevated point; carina posterior to point low, only outer margin delimited, inner portion forming large, smooth area extending across posterior of concavity; concavity most pronounced in anterior half and irregularly rugose-punctate. Outer pronotal carina on each side feebly developed, posterior end arising near posterior flared portion of inner carina; carina approximately 1.0 mm long, positioned above marginal indentation of posterior angle; lateral fovea lacking anterior carina, fovea oval, pronotal margin below fovea not indented, bead complete. Elytron lacking distinct striae or intervals on disc, surface irregularly rugose-punctate, each puncture with moderately long, semi-erect, tan seta. Metasternum between middle coxae almost flat, midline feebly indented, anterior edge at midline obtusely angulate; surface of metasternum finely punctate, each puncture with long tan seta. Fore tibia frequently with four teeth on outer margin, rarely, small basal, fifth tooth present. Genital capsule sharply rounded at apex, apex closely setose. Genitalia as in figs. 74, 75.

FEMALES. Length 9.5 to 12.5 mm, greatest width 6.5 to 8.0 mm. Differing from males of similar size mainly in having median clypeal tubercle reduced in height and in pygidium being more convex with more broadly arcuate margin. The smallest female with inner pronotal carina on each side greatly reduced in development with median angulation obtuse and feebly elevated, flattened posterior portion of concavity mostly punctate, only small lateral area on each side adjacent to carina impunctate; outer carina feeble, length reduced to 0.8 mm.

MATERIAL EXAMINED: 15 males, 16 females.

BRAZIL - Espírito Santo. St. Catharina: Corupá, I, IX; Hansa (= Corupá); Joinvile; Rio Natal, I; Salto do Pirahy near Jaraguá. Theresópolis.

Specimens are in: Berlin, Brussels, Dresden, London, New York, Paris, São Paulo, Washington, Howden.

REMARKS. Small or teneral specimens of catharinae may be difficult to place except by association, locality and use of male genitalia. However, the majority of specimens can be identified by the following combination of characters: strongly developed median clypeal tubercle; acute, inwardly directed angle of inner pronotal carina; unmodified lateral margins of pronotum and lateral third of pronotum distinctly lighter in color than central third (concavity). The closest relative to catharinae is cuspinotatus and to a lesser degree boosi from Ecuador.

23. *Neoathyreus corinthius* (Klug)

Figures 76-79, Map 4

Athyreus corinthius Klug, 1843, p. 32.*Athyreus violaceus* Klug, 1843, p. 33. NEW SYNONYMY.

TYPE. Male, labeled "corinthius Klug*, Brasil. Virm. [green label]; 25639; Typus [red label]"; in Berlin.

TYPE. Female, labeled "violaceus Klug*, Brasil. Virm. [green label]; 25641; Typus [red label]"; in Berlin.

MALES. Length 8.2 to 12.2 mm, greatest width 6.1 to 7.1 mm. Dorsally dark brown, or head and pronotum black with elytra reddish brown except black on margins and apically on and near suture, or dorsally entirely black (types). Clypeus with oblique and posterior carinae distinct; median tubercle anterior to lateral tubercle on each side, more strongly elevated; lateral tubercle feebly developed, positioned above mandibular base. Vertex flat to feebly concave, surface granular-rugose to closely granular. Pronotum (Fig. 76) with deep, distinct fossa on each side contiguous with anterior marginal bead behind eye, fossa three to four times width of adjacent bead; pronotal margin between fossae elevated to form obtuse angle at midline, small, distinct tubercle at posterior of bead forming apex of angle. Inner pronotal carina on each side strongly rounded in cross section, uniform in height, most widely separated anteriorly and feebly arcuate, closer to midline posteriorly and almost straight; concavity shallow and entirely punctate-granulate (type of *violaceus*) to moderate in depth with posterior third or half smooth, occasional punctures present; most punctures each with erect greyish-black seta. Outer pronotal carina variable; in large specimens short (0.5 mm) anterior carina present just anterior to lateral fovea, carina absent in small specimens (eg. type of *violaceus*); all specimens with posterior, feebly arcuate to sinuate carina 1.0 to 1.5 mm long; carina distinctly closer to indentation anterior to posterior angle of lateral margin than to inner carina; lateral pronotal margin not indented below lateral fovea, marginal bead not interrupted. Elytron with three or four feebly impressed, irregularly punctate striae between suture and umbone; raised intervals with smooth portions shining, remainder of surface irregularly punctate; most punctures each with semi-erect to erect seta. Metasternum flat to feebly convex, anterior edge obtusely angled, angle at midline sharp; surface of metasternum with shallow, scattered punctures each with long, pale seta. Fore tibia with five (*violaceus*) or six (*corinthius*) teeth on outer margin; development of basal tooth varying from absent, to feeble, to distinct. Genitalia as in figs. 78, 79.

FEMALES. Length 7.8 to 11.8 mm, greatest width 5.2 to 6.9 mm. Females similar to males of similar size except median clypeal tubercle slightly reduced and pygidium more convex and apically rounded.

MATERIAL EXAMINED: 6 males, 9 females.

ARGENTINA - Córdoba: Dique Los Molinos, I; Santa María, I.

BRAZIL - Bahia. Rio Grande do Sul: Caracol do Gramado, 850 m, I; Santo Augusto, X; São Leopoldo. São Paulo: Mazcillac [sic], IX.

URUGUAY - Salto: Tierras Coloradas, XII.

Specimens are in: Berlin, London, Pittsburgh, São Paulo, Tucumán, Howden.

REMARKS. It is not surprising that Klug thought the small female of *corinthius* was distinct from the male. The female (Fig. 77) he described under the name *violaceus* is the smallest specimen seen while the male type

of corinthius is one of the largest males seen. Fortunately enough additional material has become available to indicate that the differences noted by Klug can all be attributed to variation within one species. Hence the name violaceus is placed in synonymy under corinthius which has page priority.

Since both the color and outer pronotal carina show considerable variation, identification is best done by using the key and checking the characters of the male genitalia. The species is most likely to be confused with lanei, but the latter has a more northern range and the lateral margin of the pronotum is indented below the fovea.

24. Neoathyreus tridentatus (Macleay)

Figures 80-82, Map 5

Athyreus tridentatus Macleay, 1819, p. 124; Laporte, 1840, p. 102; Klug, 1843, p. 26.

Athyreus bicolor Laporte, 1840, p. 103; Klug, 1843, p. 30; Westwood, 1851, p. 464; Boucomont, 1911, p. 346.

TYPE. tridentatus Macleay, locality listed as "Brazil"; location of type uncertain, possibly in Macleay collection in Sydney.

TYPE. bicolor Laporte, location uncertain, according to Westwood (1851, p. 464) type is in Oxford (Hope coll.); if so, it is not labeled.

MALES. Length 10.9 to 14.1 mm, greatest width 6.8 to 7.9 mm. Dorsally tan (teneral), light brown or (usual condition) dark brown with lateral thirds of pronotum light brown or reddish brown. Clypeus trituberculate, median clypeal tubercle two or more times height of lateral tubercles, anterior in position, face of median tubercle rising almost vertically (in large males) above anterior clypeal edge; oblique clypeal carina on each side distinct at base of median horn, becoming less pronounced on each side near anterior, lateral clypeal angle; posterior clypeal carina distinct between tubercles. Vertex flat or very feebly concave near midline, surface evenly granulate. Pronotum (Fig. 80) with fossa on each side behind eye small, diameter approximately equal to width of adjacent anterior marginal bead; anterior pronotal margin at midline with acute, laterally compressed tubercle, maximum height of tubercle in large males about 0.6 to 0.7 mm. Pronotum posterior to anterior marginal tubercle abruptly, deeply concave, concavity extending posteriorly for approximately 2.5 to 3.0 mm; midway of length, sides of concavity tumid, abruptly limiting deeper portion to area along midline; concavity posteriorly limited by transverse smooth area. Inner pronotal carina on each side of concavity with feeble, very broadly oblique raised angle near middle above tumid area, or carina sinuate at middle (small males); posterior portion of carina strongly curved toward midline and partly enclosing smooth, transverse end of concavity; carina ending at approximately equal distance from midline or from adjacent posterior pronotal margin. Outer pronotal carina on each side varying from 0.5 to 1.3 mm in length, straight or feebly arcuate, positioned almost midway between inner carina and emarginate area of margin just before posterior angle; lateral pronotal fovea shallow, with brief, feeble carina adjacent to anterior edge and no longer than fovea, carina only rarely completely absent; lateral pronotal margin below fovea not indented, marginal bead complete. Elytron with two or three faintly indicated striae; surface closely punctate-setose, or rugose. Most elytral surface relatively dull to feebly shining. Metasternum between middle coxae flat, anterior edge obliquely

angled, angle pointed; surface with evenly spaced shallow setose punctures. Fore tibia with four (as described by Macleay, 1819) or five teeth on outer margin, one specimen with four teeth on one side, five on other. Genitalia as in figs. 81, 82.

FEMALES. Length 11.0 to 15.1 mm, greatest width 7.2 to 8.2 mm. Similar to males except in the following respects: median clypeal tubercle only slightly higher than lateral tubercles; all clypeal carinae strongly developed; anterior portion of pronotal concavity slightly shallower and less abrupt than in males of similar size.

MATERIAL EXAMINED: 81 males, 128 females.

ARGENTINA - Misiones: near San Ignacio.

BRAZIL - 100, no data. Bahia. Espírito Santo. Goiás: Monjolino, XI. Minas Gerais: V. Monte Verde, II, XII. Paraná: Curitiba, IV. Rio Grande do Sul: Col. Santa Cruz. Rio de Janeiro: Corcovado, II, IX; Guanabara, X, XI; Petrópolis. Santa Catharina: Caúna, II; Nova Teutônia, 27°11'S, 52°23'W, III, IV, IX, XII; Rio Natal, IV, IX; Rio Vermelho, III. São Paulo: Cerqueira César; Cipó, XII; Ribeirão Pires; São Paulo, XI.

Specimens are in Berlin, Brussels, Cambridge, Dresden, Eberswalde, Geneva, London, Munich, New York, Oxford, Paris, Pittsburgh, São Paulo, Tucumán, Washington, Howden.

REMARKS. There has been some confusion concerning the application of the name tridentatus Macleay. In Macleay's description (1819) four pertinent points are mentioned: color brown, pronotum with anterior median acute tubercle and with two lateral oblique angles (inner carina?), fore tibia with four teeth (in observations under description) and locality Brazil. While some specimens of tridentatus as defined herein have a minute basal fifth tooth on the fore tibia, many well developed males have only four teeth, may be almost uniform brown, and have a very distinct acute median tubercle on the anterior pronotal margin. It is the only species that is known to occur in Brazil that coincides with Macleay's description. In 1851 Westwood figured Laporte's species, bicolor, and there is little doubt that it is the same as tridentatus. In 1911 Boucomont suggested the above synonymy and many of the older specimens of tridentatus in European collections have been correctly identified.

Most of the major variation noted has been incorporated in the description. Approximately two-thirds of the specimens seen have the pronotum bicolored. The color along with the acute tubercle on the anterior pronotal margin at the midline, the shape of the pronotal carinae and concavity should distinguish well-developed specimens from other South American species of Neoathyreus. The faint, short carina frequently present just anterior to the lateral pronotal fovea is also a useful character.

Small, uniformly colored specimens may be confused with some lanuginosus but the clypeal characters and those of the lateral margins of the pronotum should separate the two. However the male genitalia (if available) is the most useful character for identification in minor specimens.

25. Neoathyreus politus n. sp.

Figures 83-85, Map 5

HOLOTYPE. Male, length 13.6 mm, greatest width 7.8 mm. Dorsally dark reddish brown with head and lateral sides of pronotum tan to reddish brown. Clypeus with both oblique and posterior carinae strongly developed; median tubercle with acute apex, anterior face rising almost vertically above anterior clypeal edge; lateral tubercle on each side above antennal insertion small, less than half height of median tubercle. Vertex slightly convex laterally, flat medially between eyes, surface closely granular, each granule with erect, long, tan seta at base. Pronotum (Fig. 83) with moderate sized fossa on each side contiguous with anterior marginal bead behind eye; fossa two to three times as wide as adjacent bead; anterior pronotal margin between fossae moderately elevated to midline; marginal bead at midline contiguous with slightly elongate, conical tubercle with apex about 0.3 mm posterior to margin. Inner pronotal carina on each side arising about 1.0 mm behind fossa, carina slightly elevated and feebly angulate near middle, carina gradually converging posteriorly with opposite carina, posterior ends separated by approximately 1.0 mm; each ending about 1.0 mm before posterior pronotal margin; concavity deep, deepest portion flat, surface smooth and polished, sides of concavity below angulation of each carina not tumid, sides smooth, steep, feebly punctate near carinae. Outer carina only present posteriorly, about 1.5 mm long, positioned slightly closer to lateral margin adjacent to posterior angle than to inner carina. Lateral pronotal margin below shallow fovea not indented, marginal bead not broken or reduced. Elytron with four or five feebly defined striae on disc, elytral surface with numerous coarse punctures, each with long, semi-erect, tan seta; surface between punctures smooth, shining. Metasternum between middle coxae feebly convex, anterior edge obtusely angulate, apex of angle sharp; surface of metasternum with numerous fine punctures, each with minute anterior granule and elongate, almost upright seta; metasternum partly obscured by setae. Fore tibia with five distinct teeth and basally with suggestion of sixth tooth on outer margin. Genitalia as in figs. 84, 85.

FEMALE. Unknown.

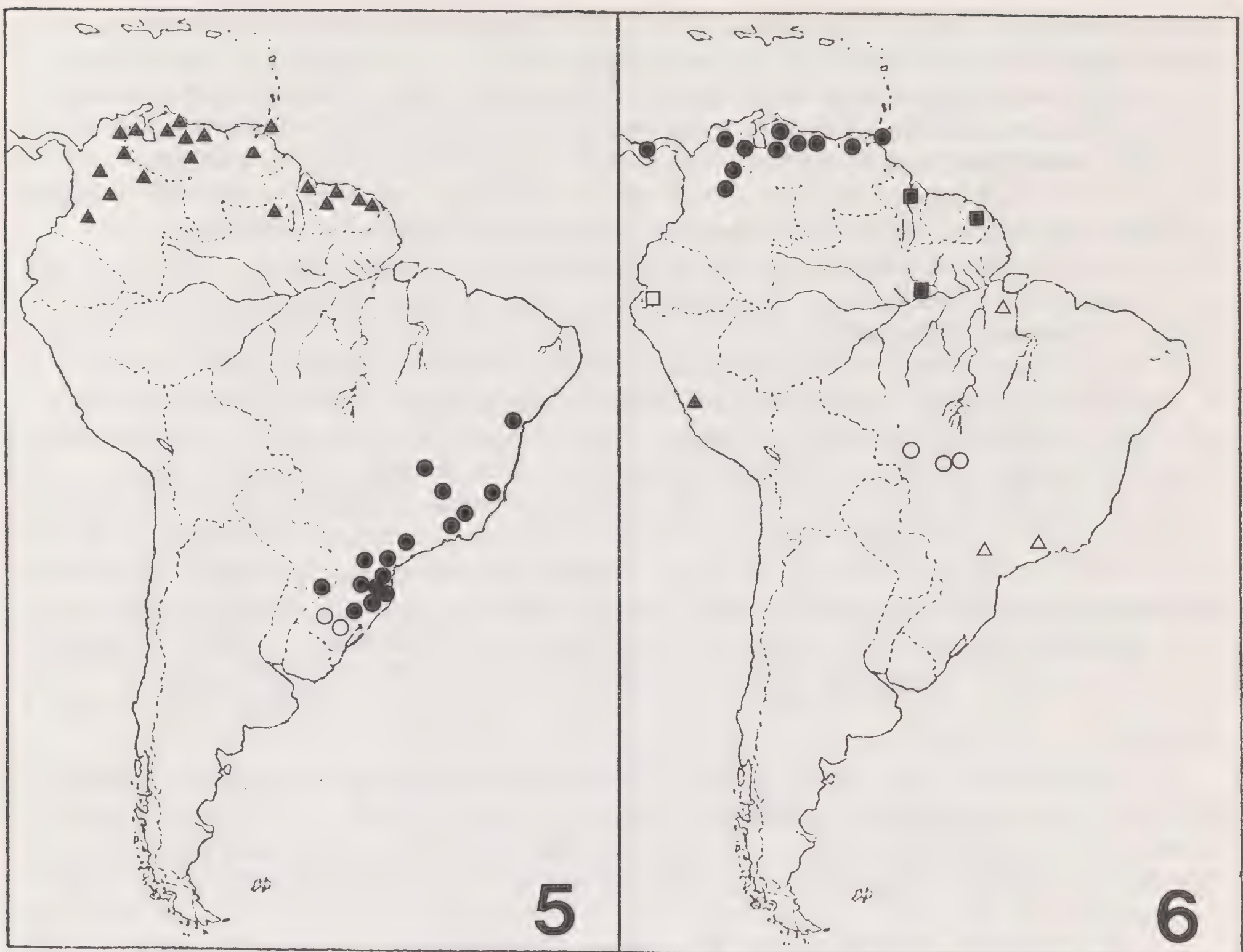
TYPE MATERIAL: Holotype, male, Brazil, Rio Grande do Sul, Santo Augusto, X.1966, O. Roppa (Pittsburgh).

PARATYPE: 1 male.

BRAZIL - Espírito Santo [31°44'S 53°02'W (?)].

Paratype is in: London.

REMARKS. Neoathyreus politus is most closely related to tridentatus. It differs from that and other related species by its highly polished pronotal concavity. In addition the five distinct teeth on the fore tibia will separate politus from tridentatus which usually has only four distinct teeth on the fore tibia.



- = 24. *tridentatus* (Macleay)
 ○ = 25. *politus* n. sp.
 ▲ = 26. *excavatus* (Laporte)

- = 27. *lanei* (Martínez)
 ○ = 28. *obscurus* n. sp.
 ▲ = 29. *ornatus* n. sp.
 △ = 30. *caesariatus* n. sp.
 ■ = 31. *illotus* n. sp.
 □ = 32. *versicolor* n. sp.

26. *Neoathyreus excavatus* (Laporte)

Figures 3-5, 86-88, Map 5

Athyreus excavatus Laporte, 1840, p. 103; Klug, 1843, p. 27; Westwood, 1851, p. 464; Bates, 1887, p. 110.

Neoathyreus quadridentatus Howden, 1964, p. 18; Howden, 1974, p. 567.
 NEW SYNONYMY.

TYPE. *excavatus* Laporte, location uncertain. Possibly male with green label "*Athyreus excavatus* de Laporte . . . [line illegible] . . . juvenis Dej, Cayenne"; in Oxford. This is certainly not Laporte's label, but the specimen matches the original description (has four teeth on fore tibia), and according to Westwood, 1851, the type is in the Hope collection.

TYPE. *quadridentatus* Howden, labeled "Lake Catemaco, Veracruz, Mexico, 8-16.VIII.1960, H.F. Howden; CNC No. 8431"; in Ottawa.

MALES. Length 9.5 to 14.1 mm, greatest width 6.4 to 8.5 mm. Dorsally tan to brown relatively uniform in color. Clypeus trituberculate, median tubercle best developed, higher and anterior to poorly developed lateral tubercles; oblique carina present on each side of median tubercle,

occasionally indistinct near anterior base of tubercle; posterior carina extending between tubercles strongly developed. Vertex flat to very feebly concave, evenly granulate or rugose. Pronotum (Fig. 86) with fossa on each side behind eye deep, diameter between one and two times width of adjacent anterior marginal bead, anterior pronotal margin with small, conical tubercle at midline, pronotum posterior to anterior margin relatively evenly, shallowly concave, concavity deepest along feebly indented midline, sides delimited by arcuate inner carina and posteriorly by impunctate, transverse smooth area. Inner carina relatively narrow, arcuately convergent with opposite carina to posterior third of pronotum, then nearly parallel, ending 0.4 to 0.6 mm anterior to posterior margin. Outer carina approximately 1.5 to 2.0 mm long, positioned midway between inner carina and inwardly arcuate pronotal margin at posterior angle. Lateral pronotal fovea on each side moderately deep, lateral margin below with marginal bead broken. Pronotal surface, except for carina and transverse smooth area at posterior of concavity, evenly granulate, similar to vertex. Elytron with four or five very feebly indicated striae, surface relatively uniformly granular, setose. Metasternum between middle coxae feebly convex, surface closely, shallowly punctate-setose, anterior edge of metasternum very broadly, obtusely angled, margin rounded except for small, sharp point at midline; midline feebly indented. Fore tibia with four teeth on outer margin. Genitalia as in figs. 87, 88.

FEMALES. Length 10.3 to 14.5 mm, greatest width 6.4 to 8.8 mm. Similar to male, differing slightly in similar sized (male vs. female) specimens by a slight reduction in height of posterior clypeal carina; pronotal concavity slightly less concave; inner pronotal carina occasionally lower or narrower.

MATERIAL EXAMINED: 40 males, 48 females.

BRAZIL - Roraima: Surumu, IX.

COLOMBIA - 3, no other data. Antioquia: Valle de Medellín, X. Bogotá. Magdalena: Río Frío, VII. Santander: Bucaramanga, IV; N. de Santander, Santiago, 700 m. V. Valle del Cauca, Cali, I.

FRENCH GUIANA - Cayenne. Gourdonville. Maroni. Nouveau Chantier, VII. Passoura, Riv. de Kourou.

GUYANA (British Guiana) - Blairmont. Kartabo, VI. Rupununi, VI.

SURINAM - Kabo, VI. Paramaribo, IV, V, VIII, X. Saramacca, Coebiti Exp. Farm, in soil at depth of 0.8 meter.

TRINIDAD - Port of Spain.

VENEZUELA - Aragua: El Limón, 450 m, V, VI, X; Maracay, 450 m, VI, XI. Bolívar, XI. Carabobo: Las Trincheras, VI; Tacarigua, VI; Valencia, IV. Caracas. Falcón: San Luis, XI. Guárico: Calabozo, V, VI. Lara: El Cují, VI; Iribarren, VIII. Monagas: Uverito, 50 m, VI, X. Zulia: Maracaibo, X, XI.

Specimens are in: Brussels, Chicago, Leiden, London, Maracay, Oxford, Paris, Pittsburgh, São Paulo, Washington, Howden.

REMARKS. The name excavatus (Laporte) has been commonly misapplied for a number of years to the Brazilian species currently called lanuginosus (Klug). The confusion has possibly stemmed partly from the uncertainty over the identity of the type specimen of excavatus and partly over the repair of one of Klug's cotypes of lanuginosus in which the apparently lost head and pronotum was replaced by gluing on the head and pronotum from a specimen of excavatus. Since specimens of Neoathyreus with five to seven teeth on the fore tibia sometimes have the number vary by the addition

or loss of a small basal tooth, the four teeth mentioned in the original description by Laporte (1840) and illustrated by Westwood (1851) were treated by many early workers such as Bates (1887) simply as varietal variation. However the male genitalia of *excavatus* are distinct and the teeth on the fore tibia do not exceed four in number (abraded specimens may seem to have three).

The species *excavatus*, while related to a number of brown species with similar non-angulate inner pronotal carinae and short, arcuate outer carinae such as *lanuginosus* (Klug), can usually be distinguished by the following combination of characters: clypeus with oblique carina on each side extending to small median tubercle, tubercle anterior in position to poorly developed lateral tubercles; vertex nearly flat, uniformly granulate; anterior pronotal margin with small tubercles on midline; pronotal concavity shallow, relatively evenly concave; inner carina on each side low, arcuate around concavity; lateral margin of pronotum below fovea indented, marginal bead broken; elytron with most of surface granulate-setose; fore tibia with four teeth on outer margin.

Neoathyreus excavatus ranges from Mexico (see *quadridentatus* Howden, 1964) to northern South America and along the Andes. I have not seen specimens of *excavatus* with accurate data from central or southern Brazil, Argentina, or Paraguay.

Little is known of the habits of *excavatus*. A few specimens have been personally collected just at dusk flying to light and two specimens were dug from shallow burrows. The burrows were found near Santiago in northeastern Colombia where some road fill had been dug from a partly forested hillside. The flat, disturbed area in which the two burrows were found was sparsely covered with a foot high growth of forbs and grasses. The soil was heavy with a high clay content and some humus.

A specimen from Colombia (in London) is labeled "Valle del Cauca, Cali, 11.I.72, dug from 2 ft. burrows, Mitchner".

27. *Neoathyreus lanei* (Martínez)

Figures 89-91, Map 6

Athyreus lanei Martínez, 1952, p. 110; Howden 1964, p. 16.

TYPE. Male, labeled "Venezuela, D. F., Cerro del Naiguatá, 720 m., VII. 43, Rene Lichy-leg." in Martínez collection.

MALES. Length 7.6 to 10.4 mm, greatest width 4.7 to 6.8 mm. Dorsally uniformly very dark brownish-black to black. Clypeus trituberculate; tubercles small, median tubercle anterior in position and slightly higher than lateral tubercles; clypeus anteriorly with transverse carina, oblique carinae lacking; posterior carina extending between tubercles well developed. Vertex flat or nearly so, uniformly granulate-punctate. Pronotum (Fig. 89) with fossa on each side very small, shallow; anterior margin medially with small tubercle; pronotum posterior to margin behind head shallowly concave, concavity limited by inner carina on each side and posteriorly by smooth, transverse area. Inner pronotal carina on each side low, moderately wide, feebly arcuate, converging to top of concavity delimited by smooth area, then parallel posteriorly to termination. Outer pronotal carina 1.0 to 1.3 mm long, arcuate, almost equidistant in position between inner carina and inwardly arcuate lateral margin just before posterior pronotal angle. Lateral fovea small with smooth groove extending

down to indented lateral margin; marginal bead absent in indentation. Elytron with one to three striae vaguely indicated basally, elytral surface rough, rugose punctate-setose, only humeral umbone smooth and shining. Metasternum between middle coxae very slightly convex, anterior edge broadly obtuse, angle prominent. Metasternal midline with fine indentation; metasternal surface with widely separated, small, setose punctures. Fore tibia with four teeth on outer margin. Genitalia as in figs. 90, 91.

FEMALES. Length 7.9 to 10.8 mm, greatest width 5.2 to 6.9 mm. No consistent external differences are evident except that the pygidium is more rounded apically than in males.

MATERIAL EXAMINED. 143 males, 22 females.

COLOMBIA - 1, no other data. Bogotá. Magdalena: Aracataca; Río Frió. Santander del Norte: La Playa, VI.

TRINIDAD - Arima Valley, 500 to 1200 ft., III. Simla. Tacarigua, XI.

VENEZUELA - 1, no other data. Carabobo: Las Trincheras, 900 m; 1000 m, V. Caracas. Cumanacoa. Los Canales. Tachira: Barrio El Lobo, X. Yaracuy: Dist. Nirgua, Caserío San Mateo, 900 m, VI.

Specimens are in: Berlin, Brussels, Cambridge, Dresden, London, Maracay, New York, Paris, San Francisco, São Paulo, Washington, Arnaud, Howden.

REMARKS. Neoathyreus lanei occurs from Trinidad across northern Venezuela and Colombia to central Panama. Specimens from Venezuela (type locality) have the finger-like apical lobe of the male genitalia stouter and somewhat shorter than specimens from either Trinidad or Panama. In addition Panamanian specimens have conspicuous erect setae on the elytra. None of these few differences seem entirely consistent and I can only conclude that the differences noted represent variation within one species.

The species, lanei, as defined here can be recognized by the following combination of characters: black or very dark brownish-black color; anterior transverse clypeal carina; small median tubercle on anterior pronotal margin; low, moderately wide, feebly arcuate inner pronotal carina surrounding shallow concavity; outer pronotal carina arcuate, positioned midway between inner carina and pronotal margin; lateral pronotal margin indented and with marginal bead broken; elytra rugose-punctate; fore tibia with four teeth on outer margin.

None of the related small, dark brown to black species such as fossulatus have the indented lateral pronotal margin with the marginal bead broken. If brown teneral specimens of lanei are found it will probably be necessary to check the male genitalia for accurate determination.

Specimens in Trinidad were taken at a kitchen light, while a large series was taken on Barro Colorado Island, Panama, in flight interception traps. A single specimen was dug from a burrow in an unused clay road fill area 3 km N. of Chinácota, Colombia (see description of area under lanuginosus). The available evidence indicates that the species is crepuscular.

28. Neoathyreus obscurus n. sp.

Figures 92-94, Map 6

HOLOTYPE. Male, length 10.1 mm, greatest width 6.1 mm. Dorsally brownish black with labrum, clypeus and most of lateral fourths of pronotum reddish brown; area of pronotal foveae dark brown. Clypeus with anterior

and posterior transverse carinae distinct; median tubercle moderately developed, slightly higher and anterior in position to lateral tubercle on each side. Vertex almost flat between eyes; surface granular, each granule with long, erect, pale seta at base; midline of posterior half of vertex smooth, slightly raised. Pronotum (Fig. 92) with small fossa on each side contiguous with anterior marginal bead, approximately equal in width to width of adjacent bead; pronotal margin between fossae moderately elevated to small, conical tubercle at midline on posterior edge of marginal bead. Inner carina on each side very slightly sinuate, almost straight and nearly uniform in thickness; inner carina most widely separated from opposite carina anteriorly, carinae gradually converging to posterior ends near posterior pronotal margin; pronotal concavity between carinae shallow, surface granular except posterior fourth smooth to within 1.2 mm of posterior pronotal margin, smooth area forming band between inner carinae. Outer pronotal carina on each side present only posteriorly, approximately 1.3 mm long with posterior end briefly curved; outer carina closer in position to lateral pronotal margin anterior to posterior angle than to inner carina. Pronotum laterally with fovea distinct, slightly elongate, lacking any trace of carina near anterior edge; pronotal margin below fovea feebly indented, marginal bead very slightly reduced, not broken. Elytron lacking distinct striae on disc, surface irregular, with numerous coarse granules, most with small setose puncture at base; surface of elytron mostly shining. Metasternum between middle coxae feebly convex, anterior edge broadly, obtusely angulate, apex keeled; surface of metasternum with numerous large, shallow setose punctures; midline slightly elevated, impunctate. Fore tibia with four distinct teeth on outer margin, basal fifth tooth indicated by feeble swelling (not considered a tooth but indicative that a fifth tooth could be present in some specimens). Genitalia as in figs. 93, 94.

ALLOTYPE. Female, length 9.8 mm, greatest width 6.4 mm. Dorsally very dark brown with only narrow band along lateral edges of pronotum light reddish brown. Similar to holotype except as follows: median clypeal tubercle lower, approximately equal in height to lateral tubercles; pronotum laterally below fovea slightly indented, marginal bead briefly broken; fore tibia with basal fifth tooth very feebly indicated; pygidium with apex more broadly rounded.

TYPE MATERIAL: Holotype, male, Brazil, Etat de Goyas, Jatahy, Ch. Pujol 1895-96 (Paris). Allotype, female, Brazil, Goyas, Rio Verde, Coll. C. Felsche, Kaul 20, 1918 (Dresden).

PARATYPES: 1 male, 1 female. 1, same data as allotype.

BRAZIL - 1, Mato Grosso: Gleba Arinos, 350 m, 7.XI.1967, leg. Viehmann.

Paratypes are in: Dresden, Howden.

REMARKS. This species has no uniquely distinctive single feature with the possible exception of the male genitalia. The one female paratype is 9.1 mm long but otherwise is similar to the allotype. The male paratype has a small basal fifth tooth on the fore tibia, but does not differ in other characters. *Neoathyreus obscurus* appears to be most closely related to *lanei* from which it differs in color, in having the pronotal marginal bead unbroken to briefly interrupted below the fovea and in slight differences in the clypeal and pronotal carinae. If uniformly dark *obscurus* occur (I suspect they may), examination of the male genitalia may be necessary to separate *obscurus* from *lanei*. In most specimens of *lanei* the lateral pronotal marginal indentation below the fovea is much more pronounced than in *obscurus*. Specimens of *obscurus* with a fifth tooth on the fore tibia will

key to inermis, but that species has seven or more teeth on the fore tibia and the male genitalia is very different.

29. Neoathyreus ornatus n. sp.

Figures 95-97, Map 6

HOLOTYPE. Male, length 13.1 mm, greatest width 7.4 mm. Dorsally light reddish-brown. Clypeus lacking any vestige of anterior carina, only posterior carina present, moderately developed; median tubercle over twice height of lateral tubercle, positioned near longitudinal center of clypeus; lateral tubercle on each side above antennal insertion feebly developed. Vertex with carina on each side at inside margin of eye, extending posteriorly about 0.3 mm, uniform in height with abruptly declivous, rounded end; vertex between carinae very shallowly concave, surface granulate-punctate, most punctures each with short, fine, pale seta. Antennal club atypical for genus, strongly oval; terminal segment with length to width ratio of 4.5:4. Pronotum (Fig. 95) with small fossa on each side adjacent to anterior margin behind eye; fossa two to three times width of adjacent marginal bead; pronotal margin between fossae feebly elevated to midline, small conical tubercle present at midline at posterior edge of marginal bead. Inner pronotal carina on each side proportionately unusually long for genus, extending from approximately 0.4 mm behind anterior fossa to 0.1 mm from edge of posterior marginal bead; carina stout, with vague inward angulation or sinuation near middle; carina gradually converging toward opposite carina, posterior ends separated by approximately 1.2 mm; concavity between unusually elongate, deepest near middle of pronotum; surface irregularly granulate to punctate, seta minute; midline shallowly impressed in posterior fourth. Outer pronotal carina on each side in two parts, short, narrow portion present just anterior to shallow lateral fovea; posterior section approximately 1.8 mm long and about 0.3 mm wide at widest point; posterior portion of carina positioned midway between inner carina and lateral pronotal margin just anterior to posterior angle. Lateral pronotal margin below shallow lateral fovea minutely indented, bead slightly reduced but not broken. Elytron with five or six striae represented by irregular rows of minute punctures; intervals with a few scattered punctures, much of surface lacking granules or punctures, slightly roughened, alutaceous; disc with only minute setae, longer, semi-erect setae present posteriorly and laterally. Metasternum between middle coxae feebly convex, anterior edge obtusely angulate, apex of angulation blunt; surface of metasternum with very small, scattered punctures, each with moderately long, fine seta. Fore tibia with four very broad, short teeth on outer margin. Genitalia as in figs. 96, 97.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Peru, Callao, Walker; G.C. Champion coll., B.M. 1927-409 (London). Paratype, male, Peru, Callao, 12 Jan. 19 (Howden).

REMARKS. The single male paratype is smaller than the holotype, measuring 11.2 mm in length and 6.5 mm in greatest width. Dorsal color is reddish brown. The median clypeal tubercle is reduced in height, a function of smaller size. The lateral pronotal margin below the lateral fovea is slightly more indented in the paratype and the anterior portion of the outer carina is greatly reduced in development. The paratype also has a very feebly developed obtuse swelling at the base of the outer margin of the

fore tibia, the swelling indicating that a fifth tooth might occasionally be evident if more specimens are found.

Neoathyreus ornatus is one of the more unusual species in the genus. It has a number of unusual characters and the combination of the oddly oval antennal club, lack of an anterior clypeal carina, very elongate pronotal concavity, and inconspicuous dorsal seta, readily identify the species. The west coast locality in Peru is also unusual. I have trouble relating this species based on synapomorphies, but it is perhaps closest to *acutus*.

30. *Neoathyreus caesariatus* n. sp.

Figures 98-100, Map 6

HOLOTYPE. Male, length 16.0 mm, greatest width 9.3 mm. Dorsally brown to dark brown. Clypeus with anterior oblique carina on each side feebly developed, posterior transverse carina strongly developed; median tubercle prominent but with sides not abruptly elevated above transverse carina; anterior face of median tubercle almost vertical, slightly posteriorly inclined near base; lateral clypeal tubercle on each side not prominent, obtusely angled. Vertex moderately convex, evenly, closely granulate, each granule with erect tan seta at base. Pronotum (Fig. 98) with small fossa on each side contiguous with anterior marginal bead behind eye, fossa equal in width to width of adjacent bead; pronotal margin between fossae elevated to feeble, rounded tubercle on marginal bead at midline, bead punctate on either side of tubercle. Inner pronotal carina on each side arising approximately 1.0 mm behind fossa, carina slender, feebly elevated, flared slightly outwardly to abrupt inward projection extending as broad, flattened area to midline, posterior edge of carina at inward bend approximately 0.6 mm from posterior pronotal margin; flattened posterior band of carina narrowed at midline but not interrupted. Pronotal concavity with small, deep oval concavity just posterior to anterior pronotal margin; anterior end of inner carina on each side arising near transverse mid-point of concavity; midline posterior to oval concavity moderately depressed, surface on each side sloping gradually upward to inner carina on each side. Outer pronotal carina on each side atypical for genus, anterior section feebly represented by fine, tenuous ridge 0.4 mm long just anterior to lateral fovea; posterior portion of outer carina more pronounced, posterior end fusing with inner carina at abrupt inward bend, thus appearing as lateral branch of posterior part of inner carina. Pronotum laterally with shallow fovea, lateral margin below fovea not indented, bead complete. Elytron with one or two striae vaguely indicated, disc of elytron irregularly granulate to rugose, each depression (irregular puncture) with semi-erect seta. Metasternum between middle coxae almost flat, midline indicated by faint groove, anterior edge obtusely angulate, apex of angle at midline with small keel; surface of metasternum with scattered shallow punctures, each with erect, fine seta. Fore tibia with four teeth on outer margin. Genitalia as in figs. 99, 100.

ALLOTYPE. Female, length 11.5 mm, greatest width 6.8 mm. Dorsally brownish-black. Similar to holotype except as follows: clypeus with both oblique and posterior transverse carinae equally, strongly developed; median and lateral clypeal tubercles greatly reduced in height, median tubercle positioned near mid-point of clypeus; pronotal concavity reduced in area, deepest at midline with sloping sides, more elongate in shape; inner and posterior sections of outer carinae slightly wider; elytron with six

distinct striae between suture and humeral umbone, intervals mostly impunctate, shining; elytral striae irregularly punctate; pygidium with broader, more rounded apex.

TYPE MATERIAL: Holotype, male, [Brazil], Pará (Howden). Allotype, female, São Paulo, Theophilo Ottoni, A. Richter Leg., 1930 (São Paulo).

PARATYPES: 4 males, 9 females.

BRAZIL - 11, no other data; 1, Rio, 10-44 on green circular label; 1, Rio Jan.

Paratypes are in: Berlin, Brussels, London, Oxford, Paris, Howden.

REMARKS. The holotype and allotype represent the approximate extremes in size and development. Several teneral specimens are light tan in color while a few worn (= old?) specimens are mostly black dorsally. The holotype is missing one antennal club and parts of all tarsi. It was selected as it was the only major male with any data other than "Brazil" that I have available. The same is true of the allotype.

The species is easily recognized by the odd fusion of the posterior end of each outer carina with the adjacent portion of the inner carina. This character will easily separate caesariatus from the closely related tridentatus and politus.

31. Neoathyreus illotus n. sp.

Figures 101-103, Map 6

HOLOTYPE. Male, length 8.8 mm, greatest width 5.5 mm. Dorsally very dark reddish brown. Clypeus with anterior oblique carina indistinct except near anterior angles; posterior transverse carina distinct, low; median tubercle small, poorly developed, slightly lower than lateral tubercle on each side. Vertex slightly tumid between eyes, surface closely, coarsely punctate except less so on median tumid area; many punctures with small granule at anterior edge; each puncture with fine, erect, tan seta. Pronotum (Fig. 101) anteriorly with small fossa on each side contiguous with anterior marginal bead; width of fossa approximately equal to width of adjacent bead; anterior pronotal margin between fossae gradually elevated to midline, marginal bead at midline briefly thickened but distinct tubercle lacking. Inner pronotal carina stout, most widely separated from midline anteriorly, approaching midline and becoming parallel posteriorly; pronotal concavity shallow, deepest in anterior fourth of pronotum; concavity between anterior portions of inner carinae with wide, smooth impunctate transverse band merging with carinae, concavity anterior to band granulate or rugose; posterior to band pronotum depressed between inner carinae with midline forming smooth indentation to posterior margin. Pronotum with outer carina on each side divided into two sections; anterior section slender, at right angles to lateral margin, extending from 0.1 mm above margin inwardly just anterior to fovea for approximately 1.5 mm; posterior section of carina three to four times width of anterior section and of almost equal length; posterior section positioned midway between inner carina and lateral margin just anterior to posterior pronotal angle. Pronotum laterally with oval fovea, margin below fovea slightly inwardly arcuate, marginal bead complete, not reduced. Elytron with two or three vague striae, surface of disc closely, coarsely punctate, each puncture with slender, erect or semi-erect seta;

surface between punctures shining. Metasternum between middle coxae almost flat with slightly raised midline, anterior edge obtusely angulate with angle at midline with small, acutely pointed tubercle; surface of metasternum with scattered, shallow punctures, each puncture with long, fine seta. Fore tibia with four teeth on outer margin. Genitalia as in figs. 102, 103.

ALLOTYPE. Female, length 8.7 mm, greatest width 5.7 mm. Similar to holotype except as follows: clypeal tubercles reduced in size and height, median tubercle slightly higher than either lateral tubercle; anterior portion of outer carina shortened, approximately 0.7 mm in length, anterior in position to lateral fovea; apex of pygidium more rounded.

TYPE MATERIAL: Holotype, male, Guyana, Bartica, 30.VIII.1973, K. Neil (Howden). Allotype, female, Guyane française, collect. C. Bar. (Paris).

PARATYPES: 3 males, 3 females. 2, same data as allotype.

BRAZIL - 1, Amazonas, Manaus, 1.III.1978, B.C. Ratcliffe.

FRENCH GUIANA - 2, Cayenne; 1, Cayenne, La Chaumière, IV.1979, P. Arnaud.

Paratypes are in: London, Paris, Howden.

REMARKS. In the type series the holotype is the largest specimen and the smallest is a male measuring 7.5 mm in length and 5.1 mm in greatest width. Variation in the series is slight, the major differences being those noted between the holotype and allotype. The smallest specimen has the pronotal concavity shallower than in larger specimens, a type of size-related variation common throughout the genus. *Neoathyreus illotus* is most closely related to the *anthracinus-latidorsalis* group of species but differs from these by lacking a tubercle on the midline of the anterior pronotal margin. Based entirely on external characters *illotus* is most likely to be confused with *lanei* but differs from that species by not having the lateral pronotal margin sharply indented and the bead broken. The male genitalia of *illotus* are very different from those of *lanei*.

32. *Neoathyreus versicolor* n. sp.

Figures 104-106, Map 6

HOLOTYPE. Male, length 8.4 mm, greatest width 5.0 mm. Color dorsally mixed tan, brown and black; labrum, clypeus and vertex except posterior edge tan, posterior edge and genae brownish-black or black; pronotum with area surrounded by inner carinae, carinae and narrow contiguous band adjacent to carinae along with posterior pronotal marginal area black; outer thirds of pronotum along with outer carinae tan; scutellum black; elytron with umbone tan, remainder of surface moderately uniform brown. Clypeus with very feebly indicated oblique carina, posterior transverse carina evident but poorly developed; median and lateral tubercles very small, median tubercle slightly higher than lateral tubercle on each side. Vertex flat between eyes, surface closely, coarsely punctate, each puncture with long, erect, pale seta. Pronotum (Fig. 104) with small fossa on each side contiguous with anterior marginal bead behind eye, fossa slightly wider than adjacent bead; pronotal margin between fossae arcuately elevated to midline, posterior edge of marginal bead at midline with minute conical tubercle. Inner pronotal carina on each side low, widest anteriorly, gradually becoming narrower posteriorly; inner carina separated from opposite carina anteriorly by approximately 1.5 mm, then gradually converging posteriorly, posterior

ends separated by approximately 0.6 mm, inner carina very slightly sinuate or curved. Pronotal concavity very shallow, indistinct, present only in anterior half of pronotum between inner carinae; surface of concavity and other pronotal surface, except for carinae and foveae, coarsely, closely punctate, each puncture with erect tan seta. Outer pronotal carina on each side arcuate, low, approximately 1.0 mm long; only present posteriorly, positioned midway between inner carina and posterior pronotal margin just anterior to posterior angle. Pronotum laterally with relatively deep oval fovea, pronotal margin below fovea slightly indented, marginal bead complete, not reduced. Elytron with four or five feebly impressed striae on disc, surface of elytron coarsely, closely, irregularly punctate, each puncture with erect dark brown seta, surface between punctures shining. Metasternum between middle coxae feebly convex, anterior edge obtusely angled, apex of angle at midline with small keel; surface of metasternum with scattered shallow punctures each with elongate, semi-erect seta. Fore tibia with four teeth on outer margin. Genitalia as in figs. 105, 106.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Equateur, Loja, Abbé Gaujon (Paris).

REMARKS. This species is related to illotus but differs in color, lacks the smooth, transverse band at the posterior edge of the pronotal concavity and differs in the characters of the male genitalia. The small size and variegated dorsal color will separate versicolor from other species of Neoathyreus. It is possible that some specimens may be more uniformly dark in color, but the other characters should still distinguish the species.

33. Neoathyreus martinezorum n. sp.

Figures 107-109, Map 7

HOLOTYPE. Male, length 13.9 mm, greatest width 9.2 mm. Dorsally light brown. Clypeus with anterior oblique carina incomplete, absent near midline; posterior transverse carina strongly developed, median tubercle distinctly more elevated than small lateral tubercle on each side, median tubercle only slightly anterior in position to transverse line between lateral tubercles. Vertex flat to very slightly concave between eyes, surface with numerous relatively small granules, each granule with erect, pale seta at base. Pronotum (Fig. 107) with relatively large fossa on each side adjacent to anterior marginal bead behind eye, fossa deep, with width three to four times width of adjacent bead; anterior margin between fossae elevated to moderate-sized, conical tubercle at midline. Inner pronotal carina on each side with anterior end beginning approximately 1.3 mm behind and outside of fossa, carina rising almost vertically to acute, upright angle above line of lateral foveae, carina then abruptly reduced in height, curved inward to posterior margin of concavity, then becoming parallel with midline to posterior end 0.3 mm before posterior pronotal margin; inner carinae unusually widely separated by approximately 5.1 mm, carinae posterior to concavity separated by approximately 2.0 mm; concavity wide and shallow, deepest medially about 1.1 mm behind anterior median pronotal tubercle; surface of concavity with numerous small granules, each with fine seta at base; midline and wide transverse band at posterior edge of concavity smooth, opaque. Outer pronotal carina on each side approximately 2.0 mm long, feebly arcuate, only posterior portion present, positioned midway between inner

carina and adjacent, inwardly arcuate pronotal margin just anterior to posterior angle. Pronotum laterally with deep, elongate fovea, elongate groove perpendicular to strongly indented lateral margin, marginal bead absent in indentation. Elytron with two or three vague striae near base of disc, surface of disc with numerous, moderate-sized punctures, each with erect or semi-erect dark brown or black seta; surface between punctures shining. Metasternum between middle coxae feebly convex, primarily along midline; anterior edge of metasternum obtusely angulate, angle at midline with small keel; surface of metasternum with numerous shallow punctures, each with anterior granule and central, erect pale seta. Fore tibia with six teeth on outer margin, basal tooth minute. Genitalia as in figs. 108, 109.

ALLOTYPE. Female, length 13.7 mm, greatest width 9.8 mm. Similar to holotype except as follows: anterior clypeal carina less oblique, joined across midline by faint arcuate ridge to opposite side, thus carina might be considered as transverse; posterior transverse clypeal carina and median tubercle lower but otherwise similar; pronotum with lateral marginal indentation slightly shallower; apex of pygidium more rounded.

TYPE MATERIAL: Holotype, male, Argentina, Jujuy, Yuto, 19.I. 1965, L. Stange (Tucumán). Allotype, female, Argentina, Jujuy, 6 km W. Yuto, INTA, 13-14.II.1982, H. & A. Howden (Howden).

PARATYPES: 1 male, same data as allotype.

BOLIVIA - 1 female, Dp. Santa Cruz: Pica Cordillera, Tararenda, XII.1960, Martínez.

Paratypes are in: Howden.

REMARKS. Other specimens of this species are in the Martínez collection. Unfortunately the specimens were seen before the study was started and I have not been able to re-examine them.

The two paratypes do not vary significantly from the description of the type of the same sex. The large size, unusually wide (5.0 mm), shallow pronotal concavity, and the anteriorly, vertically angulate inner carinae are characters that usually will distinguish the species. The most closely related species is probably *lepidus* but the pronotal carinae of the two species differ radically.

The species is named in honor of Antonio and Juana Martínez, who were wonderfully hospitable during our 1982 visit to Argentina and who were with me at Yuto when I collected the species at light.

34. *Neoathyreus latecavatus* (Boucomont)

Figures 110-112, Map 7

Athyreus latecavatus Boucomont, 1932, p. 263.

TYPE. Female, labeled "Athyreus latecavatus sp. n.; Sosomoco, Ost. Columb.; typus [red label]; Museum Paris 1938 Coll. A. Boucomont"; in Paris.

MALES. Length 13.2 to 15.5 mm, greatest width 7.0 to 7.8 mm. Dorsally very dark brown. Clypeus with irregular anterior transverse carina and strongly developed posterior carina, oblique carina absent; median tubercle slightly anterior and slightly higher than lateral tubercle on each side, clypeal face below posterior carina strongly declivous in large males. Vertex between eyes flat to feebly convex, surface closely granulate, bases of most granules each with erect tan seta. Pronotum (Fig. 110) with moderate sized fossa on each side contiguous with anterior marginal bead

behind eye, fossa two to three times width of adjacent bead; pronotal margin between fossae with small, rounded tubercle on midline. Inner pronotal carina in large specimens arising approximately 0.8 to 0.9 mm behind fossa on each side, carina not strongly elevated, slightly widened and vaguely angulate near middle, first two thirds of carina nearly parallel with midline, then curved inwardly to within 0.6 mm of midline, where carina becomes nearly parallel with midline, ending approximately 0.5 or 0.6 mm before posterior margin; in small males the carina is almost evenly convergent towards the posterior and the carina is of uniform thickness and height; pronotal concavity deepest anteriorly and along midline, concavity granulate in anterior three-fourths, smooth in posterior fourth with posterior edge between carinae sharply delimited. Outer carina on each side moderately arcuate, approximately 1.5 mm long, positioned midway between inner carina and inward arcuate margin of posterior pronotal angle; pronotal fovea on each side elongate, extending toward margin, lateral margin below fovea briefly indented; marginal bead interrupted. Elytron with three or four striae briefly, feebly developed basally, disc regularly, closely granulate, posterior base of each puncture with semi-erect tan seta. Metasternum between middle coxae feebly convex, anterior edge at midline bluntly, broadly, obtusely angled, midline anteriorly occasionally feebly indented; metasternal surface with numerous shallow, coarse punctures, each with long tan seta. Fore tibia with five teeth on outer margin. Genitalia as in figs. 111, 112.

FEMALES. Length 14.5 to 15.2 mm, greatest width 8.6 to 9.0 mm. Except for more convex and rounded pygidium, females seen did not differ externally in any major way from large males.

MATERIAL EXAMINED: 2 males, 4 females.

COLOMBIA - Río Negro. Sosomoco (type). Villavicencio.

ECUADOR - Archidona. Macas.

Specimens are in: Paris, Berlin, Howden.

REMARKS. Specimens of latecavatus may be confused with large specimens of lanuginosus but differ in the shape of the pronotal carinae, which in latecavatus are not evenly arcuate; also mature specimens of latecavatus are dark brown and the four examples seen all have five teeth on the outer margin of the fore tibia.

35. Neoathyreus rufobrunneus n. sp.

Figures 113-115, Map 7

HOLOTYPE. Male, length 12.3 mm, greatest width 7.2 mm. Dorsally dark reddish brown. Clypeus with anterior transverse carina evident only near anterior lateral angles; posterior transverse carina strongly developed; median tubercle moderately developed, slightly higher and more anterior in position than lateral tubercle on each side. Vertex almost flat between eyes, surface coarsely, closely granulate; most granules each with long, tan seta arising from base. Pronotum (Fig. 113) anteriorly with small fossa on each side adjacent to anterior marginal bead behind eye; width of fossa approximately equal to width of adjacent bead; anterior pronotal margin between fossae feebly elevated to midline, midline with very small tubercle on bead. Inner carina on each side with feeble, inwardly directed, obtuse angulation near middle, carina slightly thicker posterior to angulation; carina arcuate at posterior end of concavity, then nearly straight to termination 0.5 mm

anterior to posterior pronotal margin. Pronotal concavity longer than wide, deepest near anterior end at midline, then gradually reduced in depth to posterior end; surface of concavity granulate-punctate, most punctures each with tan seta, midline and posterior edge of concavity almost impunctate, smooth, opaque. Outer pronotal carina present only posteriorly, carina thin, approximately 1.0 mm long, positioned midway between inner carina and lateral pronotal margin just anterior to posterior angle. Lateral pronotal fovea on each side elongate, extending as groove to margin, margin below fovea deeply indented, marginal bead absent in indentation. Elytron with several striae indentations near extreme base of disc, surface of disc otherwise even and closely, irregularly punctate, giving rugose appearance; punctures each with almost erect, tan seta. Metasternum between middle coxae feebly convex, anterior edge obtusely angulate with angle at midline with small, sharp, anteriorly directed tubercle; surface of metasternum with evenly spaced, shallow punctures, each with erect, moderately long, pale seta. Fore tibia with five teeth on outer margin. Genitalia as in figs. 114, 115.

ALLOTYPE. Female, length 12.1 mm, greatest width 7.2 mm. Dorsally brownish black. Similar to holotype except as follows: anterior transverse clypeal carina more pronounced, absent in median third; median clypeal tubercle slightly lower, inner pronotal carina slightly more strongly angulate; pronotal concavity wider, with granulate-punctate area reduced; pygidium with apex more broadly rounded.

TYPE MATERIAL: Holotype, male, Peru, Tingo María, 19.IX.1960, J. Schunke (Howden). Allotype, female, Ecuador, Mera, 25.I.1923, F.X. Williams (London).

PARATYPES: 1 male, 2 females, 1, N. Grenada, (B.M.#) 67.45, and 27; 2, same data as allotype.

Paratypes are in: London, Howden.

REMARKS. The male paratype is the smallest specimen seen, measuring 10.3 mm in length and 6.8 mm in greatest width. It also differs in having the basal fifth tooth on the outer margin of the fore tibia obsolete. Otherwise the variation noted is mainly sexual and is described under the allotype. All three females have the pronotal concavity wider, particularly posteriorly, than in the males.

Neoathyreus rufobrunneus is probably most closely related to *brazilensis*, from which it differs mainly in having the sides of the pronotum below the foveae indented and the marginal bead broken. Also the genitalia of *rufobrunneus* is very distinctive.

36. *Neoathyreus perryae* n. sp.

Figures 116-119, Map 7

HOLOTYPE. Male, length 11.4 mm, greatest width 8.0 mm. Dorsally light brown. Clypeus with oblique carina strongly developed except at anterior base of median tubercle near midline, carina slightly irregular in median area; posterior transverse clypeal carina strongly developed and elevated to apex of median tubercle; median tubercle not isolated from carina, moderately higher than lateral tubercle on each side; each lateral tubercle slightly elevated above level of carina. Vertex between eyes feebly concave, surface with small granules, most separated from adjacent granules by one or two granule diameters. Pronotum (Fig. 116) with moderate sized fossa on each side adjacent to anterior marginal bead behind eye; fossa approximately

three times as wide as width of adjacent bead; anterior pronotal margin between fossae moderately elevated to small, conical tubercle at midline. Inner pronotal carina on each side enclosing concavity approximately as wide as head (measured from outer edge of genae) at widest point; carina not varying greatly in height, sinuous, curving toward midline posteriorly, paralleling midline posteriorly behind concavity; each inner carina 0.5 mm from anterior end with carinate branch extending laterally to just anterior of lateral fovea; laterally directed carina not sharply defined, sides of carina irregularly punctate or granulate, carina becoming feeble to obsolete just above and anterior to fovea, not extending to lateral margin. Pronotal concavity broad, relatively evenly concave, midline impressed at bottom of concavity and posteriorly, surface of concavity granulate or punctate, granulate area with minute setae; surface of posterior fourth of concavity smooth, opaque. Outer carina present only posteriorly above and just anterior to posterior pronotal margin, carina closer to inner carina than to margin; outer carina unusually thickened and with wide impunctate area extending inward to inner carina. Pronotum laterally with elongate fovea, lateral margin below fovea moderately indented, marginal bead absent in indentation. Elytron lacking striae on disc, surface of disc closely punctate, most punctures separated from others by one to two diameters, most punctures each with fine, semi-erect, pale seta, surface between punctures finely alutaceous. Metasternum between middle coxae moderately convex, midline slightly elevated, anterior edge obtusely angled, apex of angle slightly keeled; surface of metasternum with numerous large, shallow punctures, each with long, fine, semi-erect seta. Fore tibia with seven teeth on outer margin, basal teeth small, acute. Genitalia as in figs. 118, 119.

ALLOTYPE. Female, length 11.1 mm, greatest width 6.9 mm. Similar to holotype except as follows: anterior clypeal carina obsolete medially; posterior clypeal carina and associated tubercles lower, less well developed; width of pronotal concavity slightly less than width of head; inner pronotal carina lacking lateral branch; outer carina not as thickened, positioned midway between inner carina and adjacent margin; area between inner and outer carina punctate; elytral disc with several striae feebly indicated; apex of pygidium very slightly, more broadly, rounded.

TYPE MATERIAL: Holotype, male, Ecuador, Posorja, F. Campos R. (Washington). Allotype, female, same data as holotype (Washington).

PARATYPES: 5 males, 4 females.

ECUADOR - 2, no other data; 2, same data as holotype; 2, Balao; 1, S.W. Ecuador, in garden, R. Wright Barker, B.M. 1935-559.

PERU - 1, Ascope; 1 (pronotum only), fossil from Talara tar seeps, about 14,000 years old, TOM #74D4.

Paratypes are in: Dresden, London, Paris, Toronto, Washington, Howden.

REMARKS. The largest specimen in the type series, a male, measures 13.2 mm in length and 8.5 mm in greatest width; the smallest specimen, a female, measures 9.4 mm in length and 6.8 mm in greatest width. The most interesting variation noted in the series is the absence of the lateral branch of the inner pronotal carina in females and in one small male. In other species having a lateral branch there is little variation in the character regardless of sex or size. In several males of *perryae* the smooth, non-granulate band between the inner and outer carinae is reduced or absent. Dorsal color also varies from tan to very dark brown. Other differences are mentioned under the description of the allotype.

Neoathyreus perryae is probably most closely related to *lanuginosus*. It can be distinguished from that species by the shape of the wide, shallow pronotal concavity and the pronotal carinae.

The fossil pronotum (Fig. 117) from the Talara tar seeps of Peru matches almost exactly the pronotum of the male from S.W. Ecuador. The site of the tar seeps on the coast of Peru has been described by Churcher (1966), but since extant specimens are recorded both to the north and south of Talara on the western side of the Andes, no inferences can be made on any major range shifts or habitat changes.

The species is named in honor of Mrs. Betty Perry in recognition and appreciation of the many years that she has assisted me with the typing and preparation of manuscripts.



- = 33. *martinezorum* n. sp.
- = 34. *latecavatus* (Boucomont)
- ▲ = 35. *rufobrunneus* n. sp.
- △ = 36. *perryae* n. sp.

- = 37. *lanuginosus* (Klug)
- = 38. *lyriferus* Howden & Gill

37. Neoathyreus lanuginosus (Klug)

Figures 2, 6, 120-122, Map 8

Athyreus lanuginosus Klug, 1843, p. 28; Harold, 1880, p. 45; Bates, 1887, p. 110.

Lectotype here designated. Female, labeled "Nov. Valencia, Moritz [green label]; Klug*; Typus [red label]"; and my lectotype label; in Berlin.

The second specimen from "Nov. Val. Mor. Bahia" mentioned by Klug is now imperfect. Klug clearly states "six teeth on the fore tibia", but the head and pronotum are those of excavatus Laporte with four teeth on the fore tibia, while the remainder of the (glued together) specimen is a male which is conspecific with the female designated as lectotype.

MALES. Length 8.7 to 13.2 mm, greatest width 5.8 to 8.2 mm. Dorsally uniform light tan to brown. Clypeus lacking oblique carina, with anterior transverse carina interrupted or irregular at midline; posterior carina pronounced, median tubercle merely raised, thickened median portion of obtusely angled carina; lateral tubercles on each side poorly developed, lower than median tubercle. Vertex almost flat, very slightly, broadly concave between eyes, surface moderately granulate, sometimes less so near center of vertex. Pronotum (Fig. 120) with moderate sized fossa on each side behind eye, fossa contiguous with marginal bead and three to four times wider than bead; anterior pronotal marginal bead between fossae feebly widened and with small upright tubercle present at midline on posterior edge of bead. Inner pronotal carina on each side arising approximately 0.5 to 0.7 mm posterior to fossa, carina anteriorly separated from opposite carina by 4 mm or less (related to size of beetle), gradually converging toward opposite carina posteriorly, at posterior end of concavity being separated by 1 to 1.5 mm; carina not varying greatly in height or thickness, feebly arcuate anteriorly, nearly straight or feebly sinuous toward posterior, becoming nearly parallel with midline posterior to concavity, terminating approximately 0.5 mm from posterior pronotal margin. Pronotal concavity elongate, deepest medially, midline impressed or flattened, anterior two-thirds of concavity granulate, midline and posterior one-third largely smooth, smooth area reduced in small specimens. Outer pronotal carina present only near posterior pronotal angle, carina moderately to well developed, feebly arcuate, approximately 1.2 to 1.5 mm long, positioned slightly closer to pronotal margin than to inner carina, outer carina nearly parallel with adjacent inner carina. Lateral pronotal fovea narrow, frequently with indentation extending toward lateral margin; margin below fovea briefly indented except in some very small specimens, bead absent in indentation of larger specimens. Elytron occasionally with two or three vague striae indicated near basal margin, surface of disc uniformly closely granulate, each granule with minute setose puncture at posterior base, setae tan, of moderate length, inclined posteriorly. Mesosternum between middle coxae feebly convex, midline usually faintly impressed, anterior margin at midline sharply, broadly, obtusely angulate; mesosternal surface with well separated moderate sized punctures, each with long, semi-erect setae and frequently with minute granule at anterior edge of puncture. Fore tibia usually with six teeth on fore tibia; basal sixth tooth often absent, particularly in small or worn specimens, basal tooth rarely doubled so that fore tibia may occasionally have seven teeth. Genital capsule with setose, right-angled apex. Genitalia as in figs. 121, 122.

FEMALES. Length 8.7 to 12.7 mm, greatest width 5.6 to 8.1 mm. Very similar to males; clypeal and pronotal carinae usually slightly less developed in females when compared to males of similar size. Pygidium distinctly more convex and apex more rounded than in male.

MATERIAL EXAMINED: 141 males, 207 females.

ARGENTINA - Chaco: D'Icaño, Col. Benítez; Roque Sáenz Peña. Entre Ríos. Formosa: Laguna Blanca, I. La Rioja. Misiones: Magdalena, I. Salta: Gran Chaco; Río Tapenagá, XII. Santa Fe: Chaco de Santa Fe, Las Garzas; Río San Javier, Estancia la Nora, 13.XII.1911, 2.I.1912. Santiago del Estero: Río Salado, XI, XII. Tucumán: Concepción; Tucumán.

BOLIVIA - Santa Cruz: Buena Vista; El Cidral, I; Santa Cruz, 500 m, XII. Tarija: Tarija (II).

BRAZIL - 16, no other data. Alagoas: São Miguel dos Campos, IV. Amapá: Calçoene, VII; Tartarugalzinho, III. Amazonas: AM 010, km 268, IX; Rio Purus, Hyutanahã, II. Bahia: Lacerda; S. Antonio da Barra. Ceará: Barbalha, IV; Maceió; Russas, III. Espírito Santo: Timbuhy. Goiás: Jataí (= Jatahy); Vianópolis, XI. Mato Grosso: Chapada, IX; Cuiabá; Guaicurus, XI; Lagoa Santa, I; Pirapao, III; Rio Araguaia, Santo Teresinha, XI; Rio Verde, XI; Serra do Caraça, XII. Minas Gerais: Lambari, XI; Monte Alegre, II; Passa-Quatro; Sete Lagoas. Pará: Marco da Lagoa; Quellgebiet d. Xingu, Culiseu; Santarém. Paraná: Ponta Grossa, II. Pernambuco: Periperi. Roraimã: Mt. Roraimã, XI. São Paulo: Cipó, XI; Piracicaba, XII; Pirassununga, XI; San Miguel, I; Santo Amaro, III.

COLOMBIA - 2, no other data. Meta: Río Guayuriba, XII. N. de Santander: 3 km N. Chinácota, 1000 m, V.

ECUADOR - Loja.

FRENCH GUIANA - Cayenne. Mont de Kaw.

PARAGUAY - 2, no other data. Alto Paraná, Ciudad Pdte Stroessner, X-XI. Asunción. Caaguazú: Col. Sudetia, I; Mandijo, I. Cerro Amambay. Itapúa: 20 mi. N.E. Encarnación, XI, XII; 10 km S. Santa María, X. Primavera. Sapucay, XI. Villarrica.

PERU - Cerro Azul. Chanchamayo. Cuzco: Marcapata, Hacienda Cadena; Santa Isabel, XI, XII. Loreto: Pucallpa, IV, VI. Paucartambo. Pozuzo. Satipo, III. Tingo María. Valle Chanchamayo, 800 m.

VENEZUELA - 3, no other data. Arabopó, XII. Aragua: Maracay. Bolívar: El Dorado, IX; Gran Sabana, Chirima, X; Canaracuni, II; D.F.: Caracas, VI; El Valle, XI. Miranda: La Peñita, V; San Antonio de los Altos, 1350 m, XII. Tachira: Barrio El Lobo, IX; St. Elena. Yaracuy: San Mateo, VI, VII; 800 m, X.

Specimens are in: Berlin, Brussels, Chicago, Dresden, Eberswalde, Geneva, Leiden, London, Maracay, Munich, New York, Oxford, Paris, Pittsburgh, São Paulo, Tucumán, Washington, Arnaud, Glaser, Howden.

REMARKS. While this species is one of the most common and wide ranging species in the genus, most of the variation seen appears to be size related rather than related to range. A large specimen may have a larger and deeper pronotal concavity with a larger smooth area than is found in a small specimen. Also carinae are better developed in large specimens and their shapes may vary slightly. Despite this, major distinguishing characters remain fairly constant and there appears to be little difference in the male genitalia between specimens from Colombia and Argentina.

Most specimens personally collected have been taken at light shortly after sunset. Specimens taken near Chinacota, Colombia, were found burrowing in a wet, light-clay soil in an area dug out for road fill several years previously judging from the weedy, rather dense ground cover. The

few burrows found had a small but typical 'push-up', were vertical and attained a depth of from 10 to 14 cm. No food or other matter was evident in any of the burrows.

38. Neoathyreus lyriferus Howden and Gill

Figures 123-125, Map 8

Neoathyreus lyriferus Howden and Gill, 1984, p. 1637.

TYPE. Male, labeled "Costa Rica, Punt., S. Vito, Las Cruces, Sept.-Mar., 1982-83, B. Gill, F. [light] I. [ntercept] T. [rap]", in H. & A. Howden collection.

MALES. Length 12.3 to 14.4 mm, greatest width 7.9 to 9.2 mm. Dorsally uniformly dark brown to black. Clypeus with anterior transverse carina, carina frequently poorly defined medially; posterior clypeal carina distinct; median tubercle very slightly anterior in position and lower than lateral tubercles, outer edges of lateral tubercles slightly convergent towards apices. Vertex flat to feebly convex, surface rugose to granulate between eyes, punctate posteriorly in some specimens. Pronotum (Fig. 123) with very small fossa on each side adjacent to anterior marginal bead behind eye, width of fossa equal to one to two times width of adjacent bead; pronotal margin between fossae with small, rounded tubercle at midline. Inner pronotal carina on each side inwardly arcuate and raised to acute angle near middle of pronotal length; apex of angle of carina separated by approximately 2.0 to 2.6 mm from angle of opposite carina; inner carina obsolete posterior to angle. Concavity largely anterior to angles of inner carinae, concavity moderately deep anteriorly with midline forming distinct groove; surface of concavity rugose-punctate, most punctures each with erect tan seta. Outer pronotal carina with anterior end positioned midway between angle of inner carina and marginal indentation at posterior angle, carina not extending anteriorly toward fovea beyond emargination of angle; posterior end of outer carina fused with posterior end of inner carina, combined carinae forming flattened, smooth, transverse band extending to indented midline, posterior edge of carina on each side of midline obtusely angulate or abruptly rounded, anterior edge anterior to angulation with small oval indentation; combined carinae posteriorly lyre-shaped. Lateral pronotal fovea on each side moderate in size, elongate, lacking carina at anterior edge; pronotal margin below fovea briefly indented, marginal bead complete. Elytron basally with three to five very feebly indicated striae; surface granulate-punctate, most punctures each with tan or brown semi-erect seta. Metasternum between middle coxae flat to feebly convex, midline slightly elevated on each side, occasionally with fine median depressed line; anterior edge of metasternum at midline sharply, obtusely angulate; metasternal surface with evenly spaced shallow coarse punctures, most punctures each with long tan seta. Fore tibia usually with six teeth on outer margin, occasionally minute seventh tooth present basally. Genitalia as in figs. 124, 125.

FEMALES. Length 11.9 to 14.5 mm, greatest width 8.3 to 9.3 mm. Females similar to males except for usual pygidial differences: surface more convex, apex more broadly rounded. The more pronounced lateral clypeal tubercles with outer margins convergent anteriorly, often differs between male and female in other species but this difference is not evident in lyriferus.

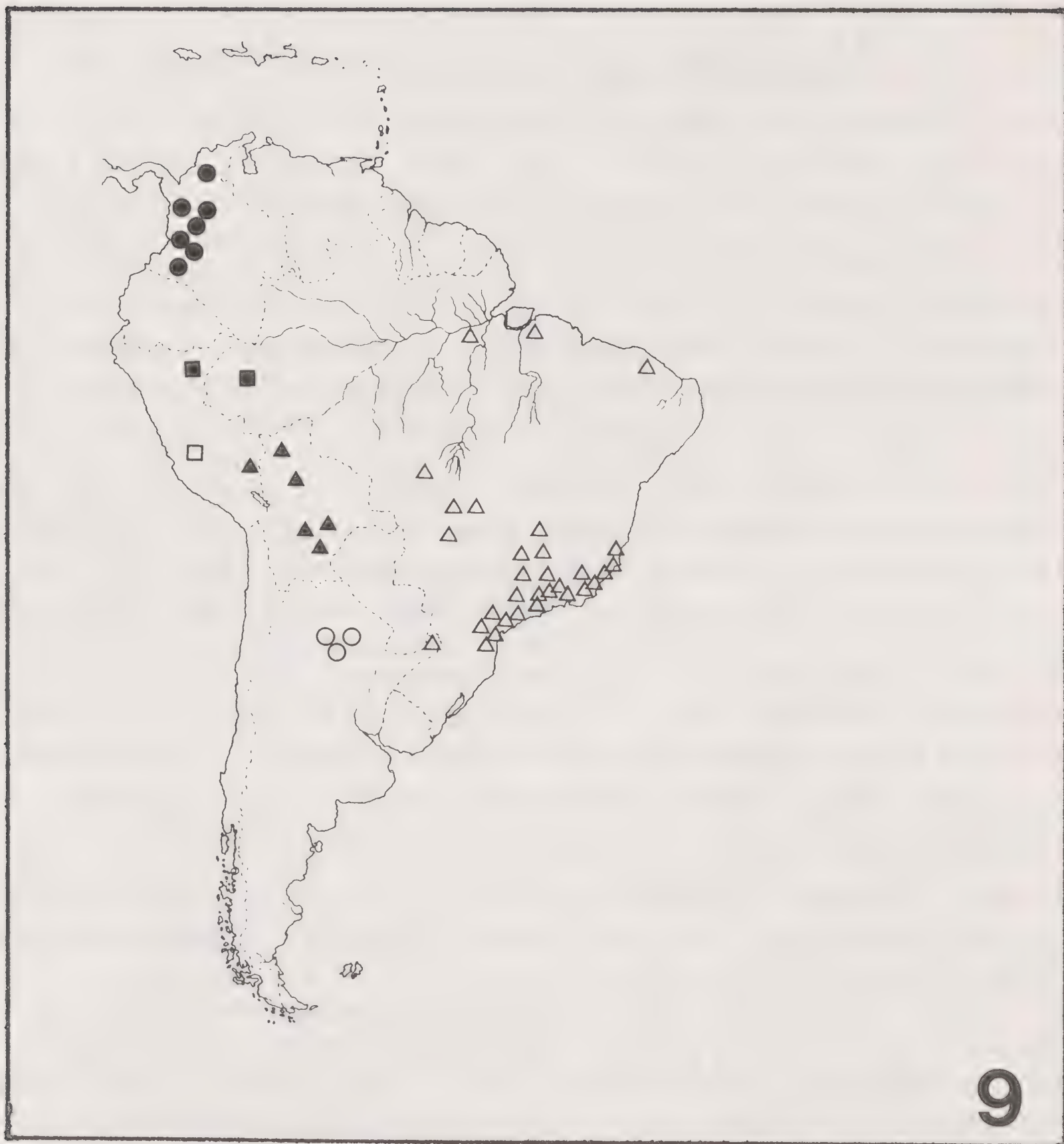
MATERIAL EXAMINED: 3 males, 11 females.

ECUADOR - Santo Domingo, IV.

Specimens are in: Glaser, Howden.

REMARKS. While the range of *lyriferus* appears to have a major disjunction (the species is only known from Costa Rica and Ecuador) there are only minor differences between the two populations. In my estimation minor differences in the shape of the pronotal carinae, which vary even within one population, do not warrant nomenclatural recognition.

Neoathyreus lyriferus belongs to a complex of species which includes *accinctus*, n. sp., and *boosi*, n. sp. The characters useful in distinguishing *lyriferus* are given in the key and comparisons are made following the descriptions of the new species.



- = 39. *accinctus* n. sp.
- = 40. *lepidus* n. sp.
- ▲ = 41. *acutus* n. sp.
- △ = 42. *brazilensis* n. sp.
- = 43. *inermis* n. sp.
- = 44. *rufiventris* n. sp.

39. Neoathyreus accinctus n. sp.

Figures 126-128, Map 9

HOLOTYPE. Male, length 14.0 mm, greatest width 8.1 mm. Dorsally dark brown. Clypeus lacking distinct anterior carina, area of carina delimited by irregular raised rugae; posterior transverse carina strongly developed; median tubercle feebly developed, very slightly anterior to line of lateral tubercles and lower; lateral tubercles pronounced, each with outer edge slanted inward, making distance between apices of lateral tubercles distinctly less than clypeal width. Vertex between eyes slightly convex near eyes, medially feebly concave to flat; surface with distinct granules, mostly separated by distance equal to diameter of two to three granules. Pronotum (Fig. 126) with small fossa on each side adjacent to anterior marginal bead behind eye, width of fossa equal to one to two times width of adjacent bead; pronotal margin between fossae elevated to small, rounded tubercle at midline. Inner pronotal carina on each side inwardly arcuate and raised to acute angle near middle of pronotal length; apex of angle of carina separated by approximately 1.5 mm from angle of opposite carina; inner carina obsolete posterior to angle. Pronotal concavity situated largely anterior to angles of inner carinae, concavity with sides concavely sloping to distinctly grooved midline; surface of concavity with scattered, small punctures each with erect tan seta. Outer pronotal carina with anterior end positioned between angle of inner carina and incurved lateral margin just anterior to posterior pronotal angle, carina anteriorly slightly closer to lateral margin than to inner carina; carina posteriorly with outer edge inwardly arcuate, about 0.3 mm from midline briefly curved anteriorly, then becoming transverse to join opposite carina; at angle formed when anterior bend becomes transverse, small, low, 0.5 mm long ridge projects anteriorly and laterally, pronotal surface just before anterior end of ridge transversely depressed; area between depression and acute angle of inner carina smooth with widely scattered, small punctures. Lateral pronotal fovea shallow, oval; pronotal margin below fovea slightly indented, marginal bead complete. Elytron lacking distinct striae on disc, surface somewhat roughened with scattered small punctures, each with semi-erect seta, surface feebly shining. Metasternum between middle coxae almost flat with slightly elevated midline, anterior edge obtusely angled, apex of angle at midline with sharp, anteriorly directed tubercle; surface of metasternum with scattered, small, shallow punctures, each with long, fine seta. Fore tibia with five teeth on outer margin. Genitalia as in figs. 127, 128.

ALLOTYPE. Female, length 15.5 mm, greatest width 8.8 mm. Similar to holotype except as follows: median clypeal tubercle slightly larger and lateral tubercles very slightly more widely separated; inner pronotal angles separated by 1.8 mm; outer pronotal carina on each side of midline more elevated (a function of size); apex of pygidium more rounded.

TYPE MATERIAL: Holotype, male, Colombia, Manizales, A.M. Patino (Paris). Allotype, female, same data as holotype (Paris).

PARATYPES: 6 males, 7 females.

COLOMBIA - 3, same data as holotype. Antioquia: Valle de Medellín, X.1941, F.L. Gallego. Cali. Chocó: Wallis. Colina Valley, nr. Buenaventura, VII.1984. Popayán, 1.VI.1938. S. Antonio. S. America, Cauca [sic].

Paratypes are in: Berlin, Paris, Washington, Boos, Howden.

REMARKS. Characters distinguishing *accinctus* show little variation. The smallest specimen seen, a male, measures 12.1 mm in length and 7.4 mm in greatest width. The allotype is as large as any specimen seen. Color varies from tan to very dark brownish-black. The distance between the acute angles of the inner pronotal carinae varies from 1.4 to 1.8 mm but appears to be always less than in the closely related *lyriferus* in which the separation of the angles varies from 2.0 to 2.6 mm. The closest relative to *accinctus* is *lyriferus* which lacks the small anteriorly directed ridge near the posterior end of the outer carina; also in *accinctus* the posterior edge of the outer carina is arcuate, not angulate. Another species in the complex is *panamensis* (Robinson) which has the inner carina continued behind the acute central angle.

40. *Neoathyreus lepidus* n. sp.

Figures 129-131, Map 9

HOLOTYPE. Male, length 15.7 mm, greatest width 9.5 mm. Dorsally light reddish brown. Clypeus with anterior transverse carina, carina irregular medially, on each side of irregular section with feeble carina extending to anterior apex of median tubercle (carina appears to be atypical oblique carina); posterior transverse carina distinct, only slightly depressed between small tubercles, median tubercle slightly anterior in position and slightly higher than lateral tubercle on each side. Vertex with sharp carina at inner edge of each eye, vertex between eyes shallowly, broadly concave; surface evenly granulate, each granulation with long, erect seta at base. Pronotum (Fig. 129) with relatively large fossa on each side adjacent to anterior marginal bead behind eye; fossa longitudinally elongate, deep portion at least four times width of adjacent bead; anterior pronotal margin between fossae elevated to small conical tubercle on midline, bead forming anterior base of tubercle. Inner pronotal carina on each side atypically divided into two parts; anterior portion arising approximately 1.5 mm behind fossa, carina low and feebly developed for anterior half of length (about 1.0 mm), last 1.0 mm more strongly developed but not greatly elevated, posterior end slightly curved inwardly; posterior section of inner carina arising 0.6 mm inside (toward midline) posterior end of anterior section and 0.4 mm anterior to termination of anterior section; anterior end of inner section highest, forming rounded low ridge bent slightly inward at anterior end; carina feebly convergent with impressed midline posteriorly, carina abruptly terminating 0.7 mm before posterior pronotal margin; broad shallow concavity mostly delimited by anterior sections of inner carinae; surface of concavity granulate-punctate, becoming smooth, impunctate between posterior ends of anterior portions of inner carinae; midline of concavity with small circular depression 1.5 mm posterior to anterior tubercle. Outer pronotal carina on each side 2.0 mm in length, almost straight, positioned midway between inflexed portion of pronotal margin just anterior to posterior angle and posterior end of anterior section of inner carina. Lateral pronotal fovea with short very feeble carina at anterior edge of fovea, fovea longer than carina; fovea with feeble indentation extending toward lateral margin; margin below fovea not modified, marginal bead not broken, very slightly reduced in height below fovea. Elytron with four or five poorly defined striae, striae represented by irregular rows of punctures, two or three intervals present with surface relatively smooth, remainder of surface closely, irregular punctate; each puncture with

long, semi-erect, tan seta; surface between punctures shining. Metasternum between middle coxae feebly convex, anterior edge obtusely angulate, angle ridged at midline; midline indicated by distinct line, metasternal surface on each side with small, distinctly separated granules, each with setose punctures at posterior base. Fore tibia with six teeth on outer margin. Genitalia as in figs. 130, 131.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Argentina, S. del Estero, Termos de Rio Honda, 16.II.1982, H. & A. Howden (Howden).

PARATYPES: 2 males.

ARGENTINA - 1, Campo del Cielo, I.1934, Petrovitz collection; 1, Tucumán: Las Cejas, 2.IV.1966, L. Stange.

Paratypes are in: Geneva, Tucumán.

REMARKS. The male paratypes measure 13.1 to 13.4 mm in length and 8.3 to 8.7 mm in greatest width. The clypeal tubercles and connecting posterior carina are less elevated (one specimen worn) than in the holotype; the vertex is almost flat in the smaller specimen, and the small carina at the anterior edge of each lateral pronotal fovea is obsolete in both. Other major differences between the specimens are not obvious.

The odd pronotal characters, particularly the shape of the divided inner pronotal carina immediately distinguishes the species from other Neoathyreus. It is not easily placed with any other species or group. Based on some pronotal characters it is possibly closest to goyasensis, while other characters, including the characters of the male genitalia, place it near martinezorum.

The holotype was found on the ground near a 15 watt black light placed in thorn scrub near the Rio Honda.

41. Neoathyreus acutus n. sp.

Figures 132-134, Map 9

HOLOTYPE. Male, length 12.6 mm, greatest width 8.0 mm. Dorsally tan. Clypeus with anterior (oblique?) carina present only on anterior lateral thirds of clypeus, absent medially; posterior transverse carina distinct; median tubercle moderately developed, transversely rounded, distinctly higher than small lateral tubercle on each side. Vertex between eyes very slightly concave; surface with numerous, very small granules, each with fine, erect, tan seta. Pronotum (Fig. 132) with fossa on each side adjacent to anterior marginal bead behind eye, fossa approximately as wide as adjacent marginal bead; pronotum between fossae feebly elevated to small, sharply conical tubercle on midline. Inner pronotal carina straight, elevated to obtuse, upright angle at anterior third, then lower at posterior end; pronotal concavity between inner carina elongate; concavity finely, closely granulate in anterior half, smooth, opaque in posterior half, midline impressed. Concavity ending posteriorly approximately 1.8 mm before posterior margin. Outer pronotal carina on each side present only posteriorly, carina arcuate, approximately 1.5 mm long and positioned midway between inner carina and inwardly arcuate lateral pronotal margin just anterior to posterior angle. Pronotum laterally with shallow, oval fovea; margin below fovea very slightly indented, marginal bead reduced but not broken in indentation. Elytron with two very feebly depressed striae on disc; elytral surface closely granulate-punctate, each puncture with fine,

semi-erect, tan seta. Metasternum between middle coxae feebly convex, anterior edge obtusely angled, apex of angle at midline with low, rounded keel; surface of metasternum with small, scattered, shallow punctures, each with fine, erect, long seta. Fore tibia with six teeth on outer margin, teeth more distinctly rounded at apex than in related species. Genitalia as in figs. 133, 134.

ALLOTYPE. Female, length 11.5 mm, greatest width 7.8 mm. Dorsally light brown. Similar to holotype except as follows: angle of inner pronotal carina less elevated; outer pronotal carina reduced in length, approximately 1.0 mm long; lateral pronotal margin below fovea with marginal bead complete, not reduced; pygidium with apex more rounded.

TYPE MATERIAL: Holotype, male, Bolivia, Sta. Cruz de la Sierra, 450 m, J. Steinbach, Nov. 1910, C.M. Acc. 4552 (Pittsburgh). Allotype, female, same data as holotype (Pittsburgh).

PARATYPES: 18 males, 23 females.

BOLIVIA - 2, no other data; 6, same data as holotype. Beni: Rurrenabaque, I, Wm. M. Mann. Chapare Region, 400 m, 25.VIII.1957, Zischka. Quatro Ojos, XI.1913. Santa Cruz: 500 m, 23.X.1953, XII.1957, Zischka; Buena Vista, 1922, R.C. Robert; IV.1950; El Cidral, 28.I.1962. Santa Cruz de la Sierra (= Prov. del Sara), 450 m, XI.1910, J. Steinbach.

[BOLIVIA, Pando] - Chivé, Madre de Dios, 200 m, Capit. Mailles, 1912.

PERU - [in] south east, Ehrman coll.

Paratypes are in: Berlin, Dresden, London, Munich, Ottawa, Paris, Pittsburgh, San Francisco, Washington, Arnaud, Howden.

REMARKS. While this species is fairly common in collections, variation in the series seen is not great. Size ranges from 9.0 to 12.9 mm in length and from 6.1 to 8.1 mm in greatest width. Dorsal color is uniform, varying from tan to light brown. The fore tibia may occasionally have only five teeth on the outer margin. Very small specimens have the upright obtuse angle of the inner pronotal carina scarcely indicated, while very large specimens may have the same carina very feebly sinuate behind the angulation. In other respects the series shows little variation other than that noted under the allotype.

The closest relative to acutus is probably goyasensis but that species lacks the outer pronotal carina. Neoathyreus brazilensis is also related, but the inner pronotal carina of brazilensis is directed inwardly. The almost straight inner pronotal carina and upright angle, combined with the presence of an outer carina and five or six teeth on the fore tibia will usually serve to distinguish acutus from any other uniformly tan or brown species of Neoathyreus.

42. Neoathyreus brazilensis n. sp.

Figures 135-137, Map 9

HOLOTYPE. Male, length 13.4 mm, greatest width 7.9 mm. Dorsally light brown. Clypeus with oblique anterior carina on each side, carina medially near base of median tubercle reduced in development, slightly irregular; posterior transverse carina strongly developed; median tubercle moderately developed, higher and more advanced in position than lateral tubercles. Vertex almost flat, very slightly depressed near midline; surface closely, finely granulate, most granules each with fine, erect seta at base.

Pronotum (Fig. 135) with small fossa on each side adjacent to anterior marginal bead behind eye, fossa approximately as wide as adjacent bead; margin between fossae elevated to conical tubercle at midline, tubercle arising from posterior edge of bead. Inner pronotal carina on each side inwardly, obtusely angled near middle, angle separated from opposite one by approximately 2.2 mm, inner carinae more widely separated anterior to angle than posteriorly, each inner carina extending posteriorly to 0.5 mm before posterior pronotal margin. Pronotal concavity more pronounced in anterior half, terminating posteriorly about 1.1 mm before posterior margin; surface of concavity anteriorly finely granulate-setose, posteriorly and laterally near carina smooth, opaque. Outer pronotal carina on each side with vague, fine, short, ridge just anterior to lateral fovea and distinct, sinuate posterior carina approximately 1.7 mm long; distinct portion of carina positioned midway between inner carina and pronotal margin just anterior to posterior angle. Pronotum laterally with oval fovea, margin below fovea not indented, marginal bead complete, not reduced. Elytron with two feebly elevated, mostly impunctate intervals on disc, remainder of surface closely punctate-granulate, punctures each with erect or semi-erect tan seta; surface between granules and punctures shining. Metasternum between middle coxae moderately convex, anterior edge obtusely angulate, angle at midline rounded, not keeled or tuberculate; surface of metasternum with scattered small punctures, each with long, erect, tan seta. Fore tibia with five teeth on outer margin. Genitalia as in figs. 136, 137.

ALLOTYPE. Female, length 13.0 mm, greatest width 8.1 mm. Similar to holotype except as follows: oblique clypeal carina broken, irregular medially near base of median tubercle; all clypeal tubercles slightly reduced in size and height; inner pronotal carinae lower, distance between angles 2.5 mm; pronotal concavity slightly shallower; fore tibia with indication of basal sixth tooth on outer margin; pygidium more convex, apex more rounded.

TYPE MATERIAL: Holotype, male, Brazil, S.P., Salesópolis, 850 m, Est. Biol. Boracéia, 28-29.XI.1974, light Mzusp col. (São Paulo). Allotype, female, Brazil, S. Paulo, Faz. Pau D'Alho, Itu, 12-15.XI.1960, U. Martins (São Paulo).

PARATYPES: 55 males, 76 females.

ARGENTINA - Misiones.

BRAZIL - 4, no other data; 1, same as holotype. Bahia: Cachimbo, Ch. Pujol, 1890; V. de Poll. Espírito Santo: F. Hoffman; Itapemirim, F. Ohaus S.; F. Jerusalem, 20.XI.1912, J.F. Zikan; Jetibá, XI.1963; João Neiva, X.1965. Goiás: Jataí, Faz. Aceiro, X.1962; Rio Verde. Maranhão: 50 km E. Canindé, Aldeia Aracu, V.1963, Malkin. Mato Grosso: Km 100, BR 55, 21.XI.1960, Arango & Martins. [Mato Grosso]: Chapada, X. Minas Gerais: Aquas Vermelhas, XII.1983, M. Alvarenga; Lambari, XI. 1924; III.1925; Uberara, Le Moul't; Viçosa, X.1930; Virgínia [sic], X.1950. Pará: Barbacena, Candeze coll. Rio de Janeiro: Itatiaya, F. Ohaus S.; Petrópolis, F. Ohaus S. Santa Catharina: Hansa [= Corupá], Humboldt; Rio Bonito, XI.1964, A. Maller. São Paulo: Anhembi, Faz. Barreiro Rico, XI.1965, W.D. Edmonds; Barueri, 26.XI.1954, 26.I.1955, 12.XI.1960, 5.XI.1961, K. Lenko, B. Malkin, XI, XII.64; Campinas, A. Braatz; 28.XII. 1940; Campos Jordao, Eug. Lefevre, 1200 m, 13-20.XI.1952, d'Almeida & Pd. Pereira; Cipó, 11.II.1972, 18.XI.1972, 16.I.1973, V.N. Alin; (Coqueiros), Ribeirão Preto, X.1954, 1956, M.P. Barretto; Itu, Faz. Pau D'Alho, 15.XI.1960, 29.X.1965, U. Martins, Baisi, 12-15.XI.1960, M.A. Vulcano; 10.I.1960, Pd. Pereira; Itu, Vila Nova, I.1963, U. Martins; Metz

[sic]; Pindamonhangaba, Eugenio Lefevre, 26.X.1962; Piquete; Piracicaba, 22.XII.1965, C.A. Triplehorn; Pirassununga, 4.X.47, Schubart; Rio Claro, XII.1940, F. Pereira; Salesópolis, B. Malkin, X; Santo Amaro, III.1957, J. Lane; Sorocaba, X.1935, Mendez; Tremembé, XII.1939, 28.I.1940, Halik; Ypiranga, F. Ohaus S.

Paratypes are in: Berlin, Brussels, Dresden, Eberswalde, Geneva, London, Oxford, Paris, Pittsburgh, São Paulo, Tucumán, Washington, Arnaud, Glaser, Hardy, Howden.

REMARKS. Except for size which varies from 9.1 to 13.6 mm in length and from 7.1 to 8.3 mm in greatest width, most of the morphological differences are included in the descriptions of the holotype and allotype. The inner pronotal carinae in very small specimens lack a distinct angle and isolated small specimens are often difficult to determine, particularly females. If the characters of the clypeus and male genitalia are given considerable weight, *brazilensis* is related to *lanuginosus* while the inner pronotal carina relates *brazilensis* to *sexdentatus*.

Neoathyreus brazilensis is a relatively abundant species that has been represented in collections for many years. It has been misidentified under a variety of names including *excavatus* and *sexdentatus*. However none of these older names can be applied to the present species. Information on labels show that a number of specimens were collected at light.

43. *Neoathyreus inermis* n. sp.

Figures 138-140, Map 9

HOLOTYPE. Male, length 8.4 mm, greatest width 5.7 mm. Dorsally very dark brown with labrum, clypeus, and lateral edges of pronotum reddish brown. Clypeus with poorly defined anterior transverse carina, posterior transverse carina distinct; median and lateral clypeal tubercles feebly developed, represented by thickening of carina at median and lateral angles; median tubercle slightly anterior to lateral tubercles, all tubercles of similar height. Vertex between eyes with central third flat to very feebly concave; surface closely granulate. Pronotum (Fig. 138) with moderate-sized fossa on each side contiguous with anterior marginal bead behind eye, diameter of fossa equal to two to three times width of adjacent bead; pronotal margin between fossae elevated to small, rounded tubercle at midline. Inner pronotal carina of uniform height, low, strongly convex in cross section, 0.2 to 0.3 mm wide; anterior ends of inner carinae widely separated, then gradually converging to pronotal midpoint, thence almost parallel to posterior ends. Pronotal concavity very shallow, limited to anterior third of pronotum between inner carinae; posterior edge of concavity delimited by oval smooth areas on each side of slightly impressed midline; remainder of surface of concavity closely granulate. Outer pronotal carina on each side limited to posterior half of pronotum, similar in height and appearance to inner carina; carina arcuate, approximately 1.3 mm long, positioned midway between inner carina and lateral pronotal margin just before posterior angle. Lateral pronotal fovea shallow, almost circular, margin below fovea shallowly indented, marginal bead reduced and very briefly broken in indentation. Elytron lacking striae on disc, surface closely, coarsely punctate; punctures separated by less than one diameter, each puncture with fine, semi-erect tan seta; surface between punctures shining. Metasternum between middle coxae flat, midline very slightly elevated; anterior edge

obtusely angled, angle at midline with low keel; surface of metasternum with unusually widely separated, shallow punctures, each with long, erect seta. Fore tibia with eight teeth on outer margin. Genitalia as in figs. 139, 140.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, Brazil, Hyutanahã, Rio Purus, S.M. Klages, March 1922, Carn. Mus. Acc. 6963. (Pittsburgh).

PARATYPE: 1 male.

PERU - Loreto: Ucayali, R., Yarina Cocha, 23.V.1957, Peter Hocking.

Paratype is in: Chicago.

REMARKS. The single male paratype is approximately the same size as the holotype. It varies from the holotype in being dorsally reddish-brown except for the brownish-black smooth posterior edge of the pronotal concavity and the adjacent portion of the inner carinae. The outer edge of the fore tibia has seven teeth instead of the eight found on the holotype. Otherwise the two specimens are similar.

Neoathyreus inermis is most closely related to obscurus, but differs from that species in size (smaller) and in having seven or eight teeth on the fore tibia; obscurus has four with a fifth sometimes indicated. The large number of teeth on the fore tibia of inermis combined with its small size and the shape of the pronotal carinae will usually distinguish the species from others in the genus.

44. Neoathyreus rufoventris n. sp.

Figures 141-144, Map 9

HOLOTYPE. Male, length 14.7 mm, greatest width 8.6 mm. Dorsally black, ventrally mostly reddish brown. Clypeus worn, oblique carina indicated, extending to anterior apex of moderately sized median tubercle, posterior carina on each side of median tubercle pronounced; lateral tubercle on each side low (worn). Vertex between eyes shallowly concave, surface rugose or with mixed granules and punctures, most depressions or punctures each with short brown seta. Pronotum (Figs. 141, 142) with small fossa on each side contiguous with anterior marginal bead behind eye, width of fossa approximately equal to width of adjacent bead; anterior pronotal margin between fossae upwardly, broadly, transversely arcuate, highest at midline; midline lacking tubercle or keel, not modified. Inner pronotal carina on each side arising about 1.0 mm behind fossa, most widely separated from opposite carina anteriorly; carina feebly inwardly arcuate and elevated to abrupt, obtuse angle near middle, then gradually reduced in height to posterior end 1.1 mm before posterior pronotal margin; concavity longer than wide, granulate in anterior half, smooth posteriorly; midline indented in posterior half. Outer pronotal carina on each side present above inwardly arcuate portion of posterior pronotal angle, carina slightly closer to margin than to adjacent portion of inner carina; outer carina approximately 1.3 to 1.4 mm long, anterior end reduced, gradually disappearing. Lateral pronotal fovea on each side poorly defined, shallow, pronotal margin below fovea slightly indented, bead reduced in size in indentation but not interrupted or broken. Elytron with two or three vaguely indented striae on disc; entire surface of elytron except for umbone closely, coarsely, contiguously punctate, most punctures each with short semi-erect brown seta. Metasternum between middle coxae flat, feebly elevated medially along midline, anterior

edge at midline sharply, obtusely angulate; surface of metasternum with scattered shallow punctures, each with long brown seta. Fore tibia worn, four teeth distinct, small fifth basal tooth vaguely indicated. Genitalia as in figs. 143, 144.

FEMALE. Unknown.

TYPE MATERIAL: Holotype, male, [Peru], Pozuzo, Coll. Dr. Ondrej (Chicago).

PARATYPE: 1 male.

PERU - Chanchamayo, F6032 Bassler Collection.

Paratype is in: Washington.

REMARKS. The single male paratype is 12.2 mm long and 7.1 mm wide. It is less well developed than the holotype but is also less worn. The oblique clypeal carina is feebly developed and there are six teeth on the outer margin of the fore tibia. The other distinctive characters do not differ greatly from those described for the holotype.

Neothyreus rufoventris superficially resembles several species occurring in Peru, Ecuador or southern Colombia. However the combination of characters found in *rufoventris* does not seem to fall within the possible limits of variation of any other species I have seen. It appears externally to be close to *rufobrunneus* but differs by having the lateral margin of the pronotum unmodified and also by having very distinctive male genitalia.

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I would first like to extend my thanks for the help given me by those individuals and institutions listed under the heading "Collections Studied". Without their generous cooperation this study would not have been feasible. I would like to particularly acknowledge the generous help and hospitality afforded me and my wife, Anne, by Antonio Martinez, his wife Juana, and his family during a seven-week visit to Argentina in 1982. During this period all of us were hosted for several weeks by the Instituto de Investigaciones Entomologicas Salta (INESALT). While there Rdo. P. Gregorio J. Williner and Dr. Manuel J. Viana, both members of INESALT were most helpful. In producing this work the assistance of Mr. L. Ling with the Scanning Electron Micrographs, plates and maps and Mrs. Betty Perry with the typing of the manuscript has been invaluable. The laboratory portion of this work has been supported by an operating grant from the National Sciences and Engineering Research Council of Canada.

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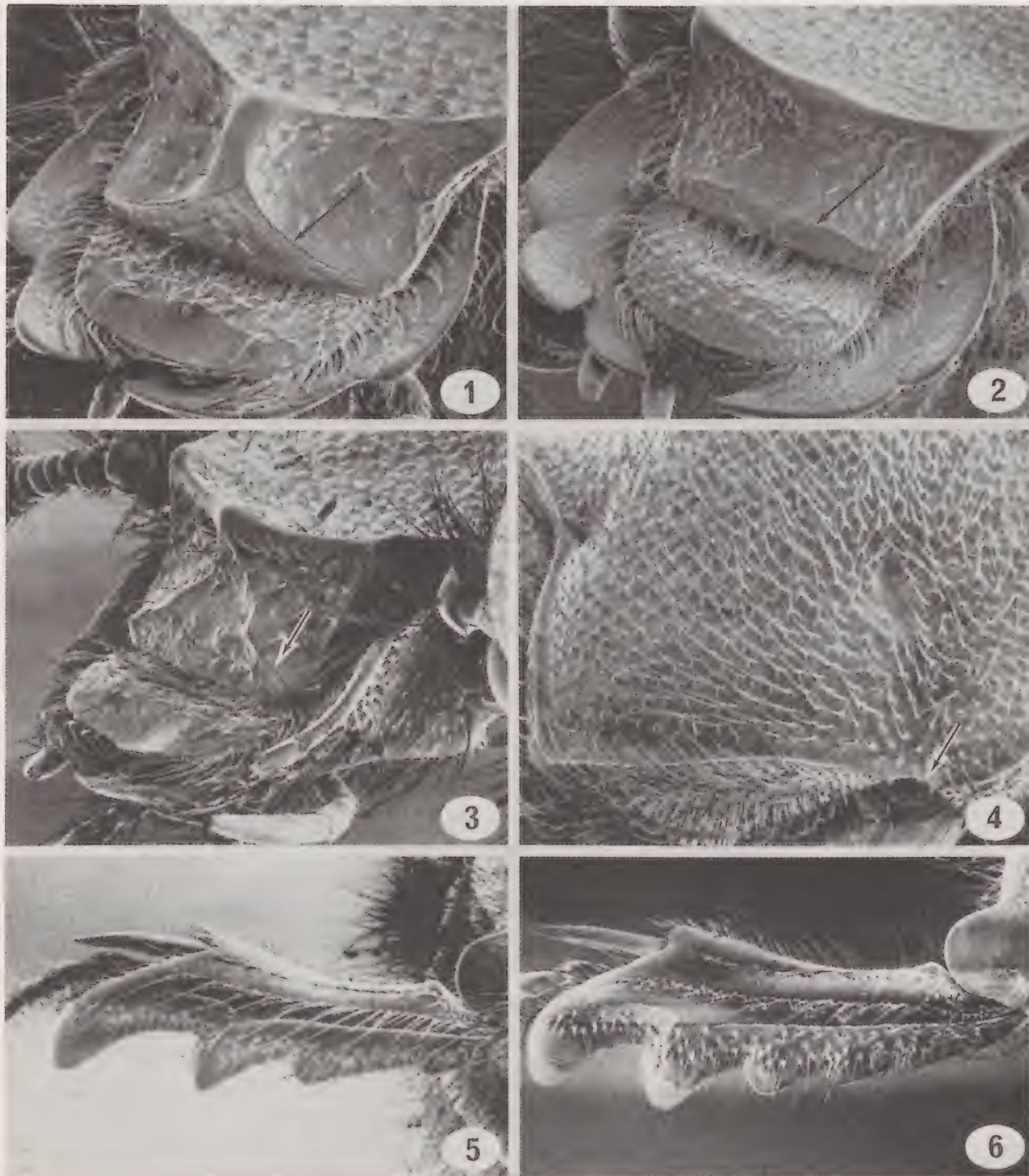
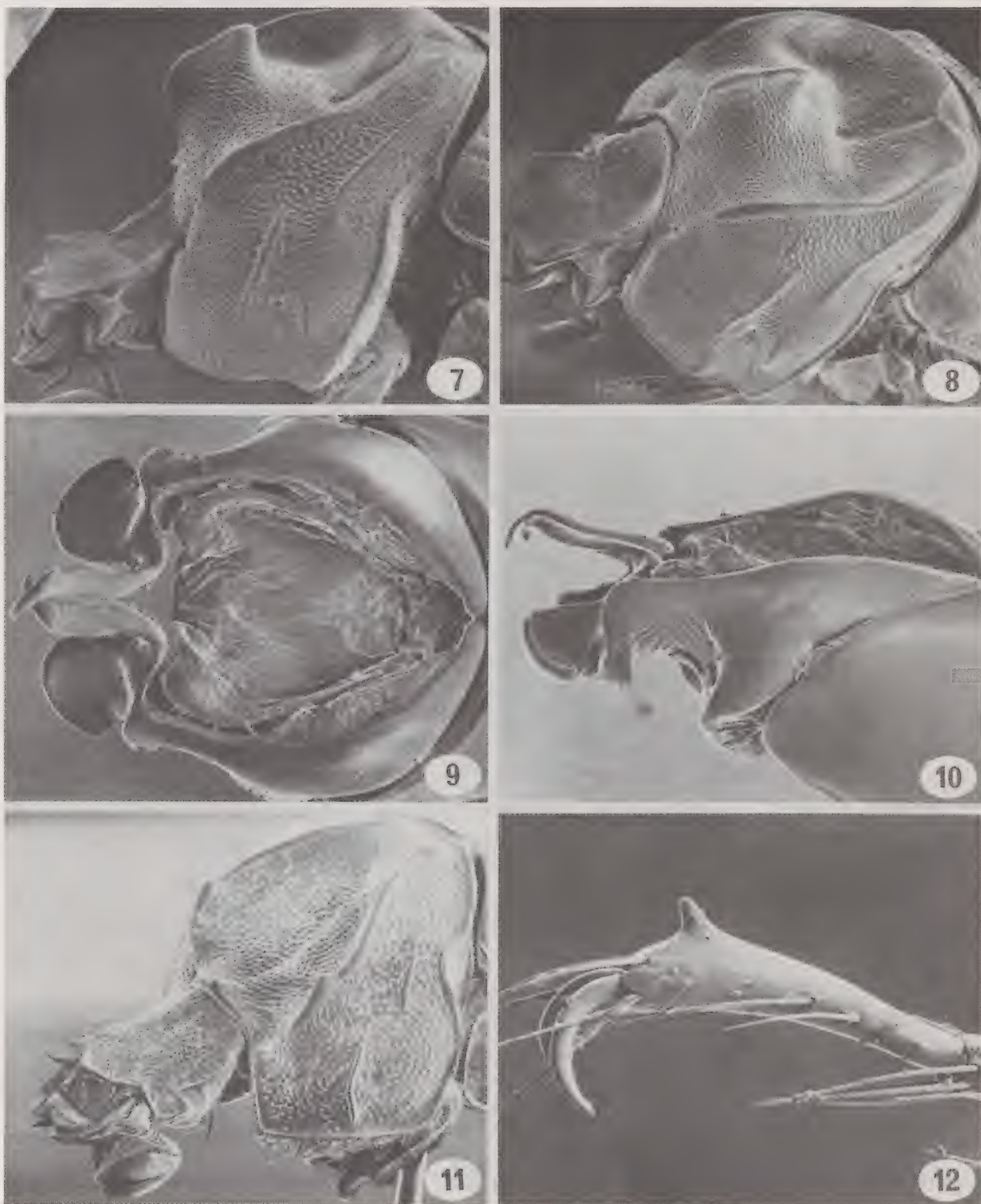
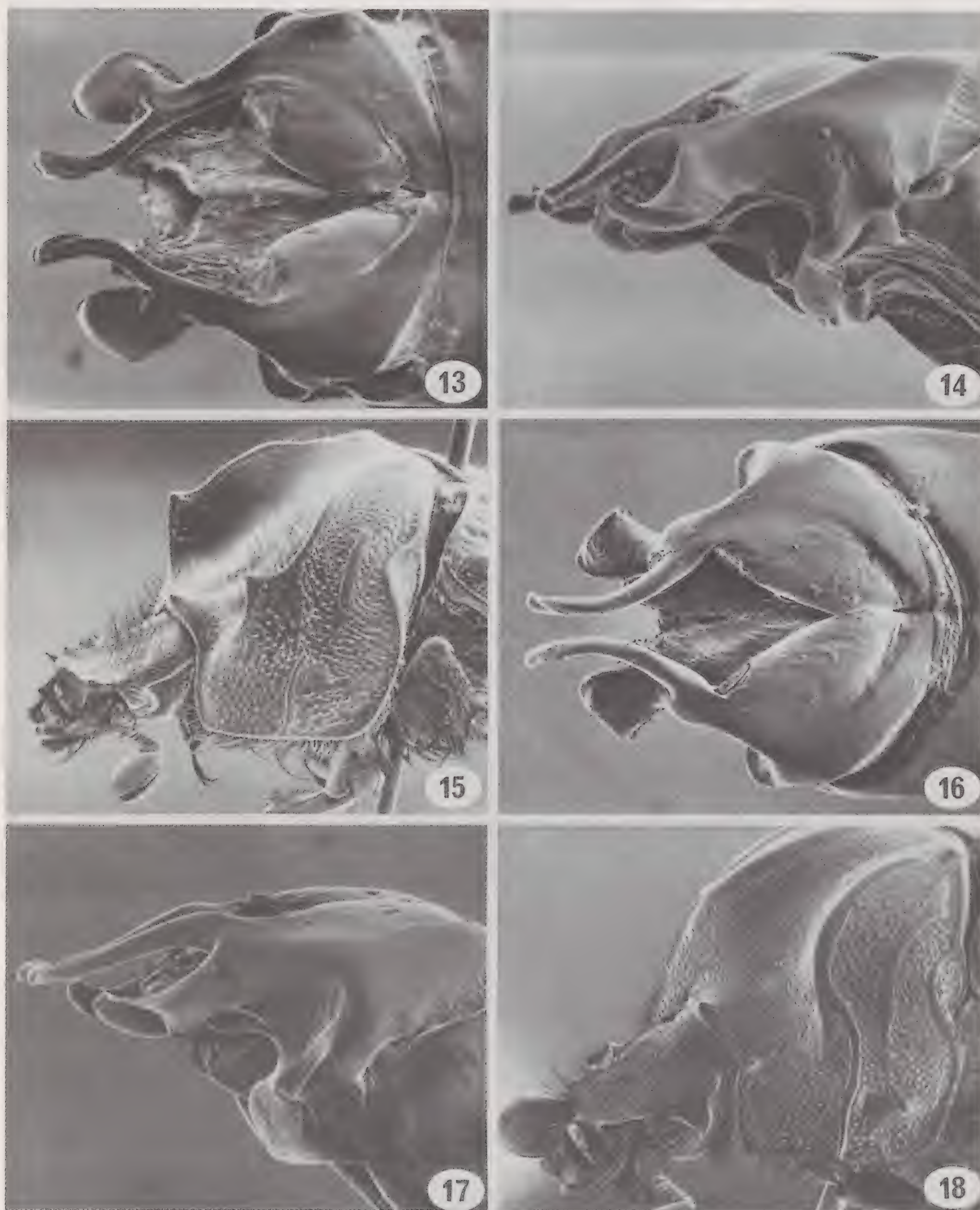


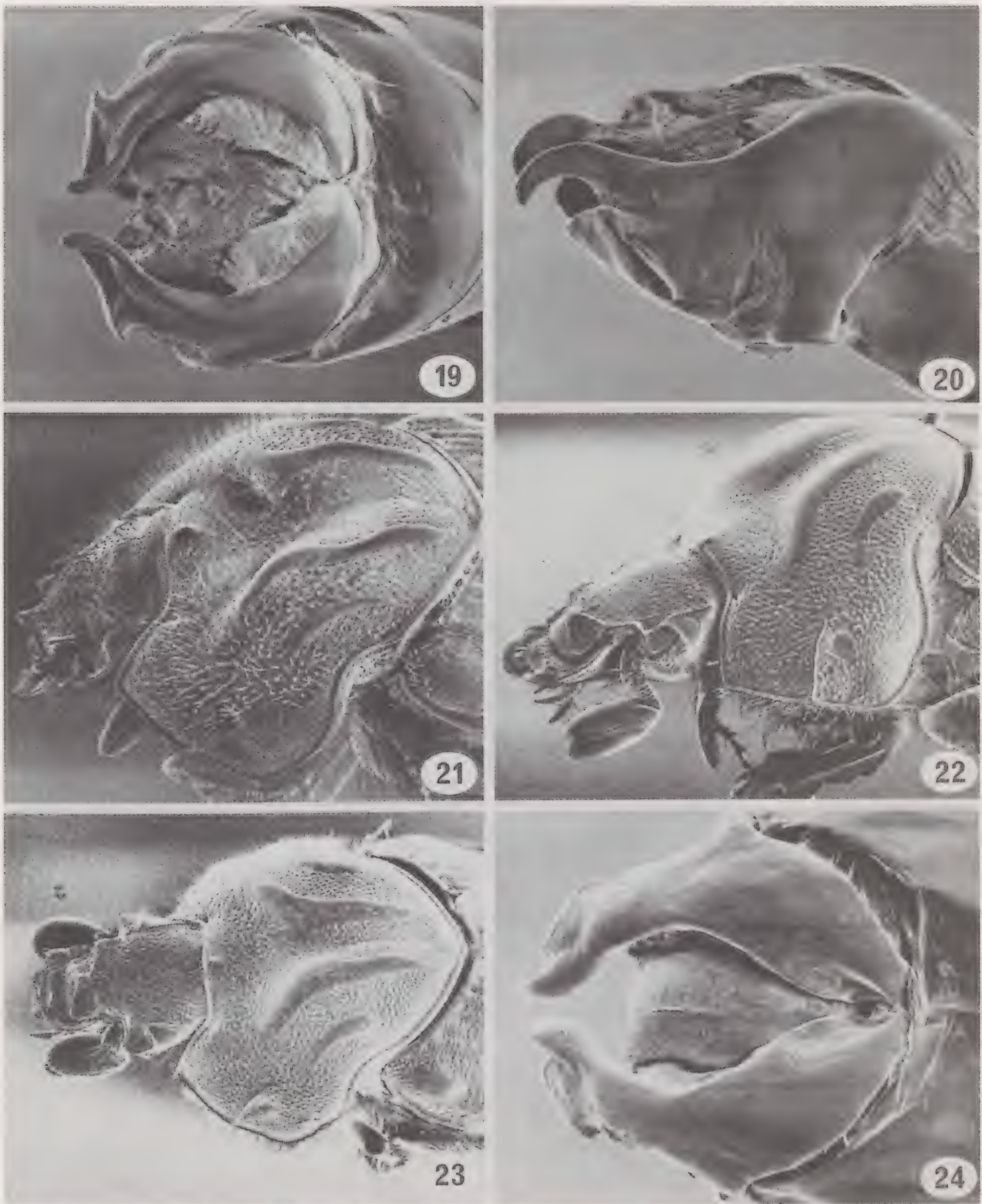
Fig. 1. Oblique clypeal carina, sexdentatus (Laporte). Fig. 2. Anterior transverse clypeal carina, lanuginosus (Klug). Fig. 3. Irregular, broken, oblique, clypeal carina, excavatus (Laporte). Fig. 4. Indented lateral pronotal margin, marginal bead interrupted, excavatus (Laporte). Fig. 5. Fore tibia with four teeth, excavatus (Laporte). Fig. 6. Fore tibia with six teeth, lanuginosus (Klug).



Figs. 7-10. *Neoathyreus glaseri* n. sp. 7, 8. Male, head and pronotum; 9. Male genitalia, dorsal view; 10. Male genitalia, lateral view. Figs. 11, 12. *Neoathyreus arribalzagai* (Martínez). 11. Male, head and pronotum; 12. Apical segment of hind tarsus.



Figs. 13, 14. Neoathyreus arribalzagai (Martínez). 13. Male genitalia, dorsal view; 14. Male genitalia, lateral view. Figs. 15-17. Neoathyreus flavithorax (Arribalzaga). 15. Male, head and pronotum; 16. Male genitalia, dorsal view; 17. Male genitalia, lateral view. Fig. 18. Neoathyreus viridis (Boucomont). 18. Male, head and pronotum.



Figs. 19, 20. *Neoathyreus viridis* (Boucomont). 19. Male genitalia, dorsal view; 20. Male genitalia, lateral view. Fig. 21. *Neoathyreus anfractus* n. sp. 21. Female, head and pronotum. Figs. 22-24. *Neoathyreus latidorsalis* n. sp. 22, 23. Male, head and pronotum; 24. Male genitalia, dorsal view.

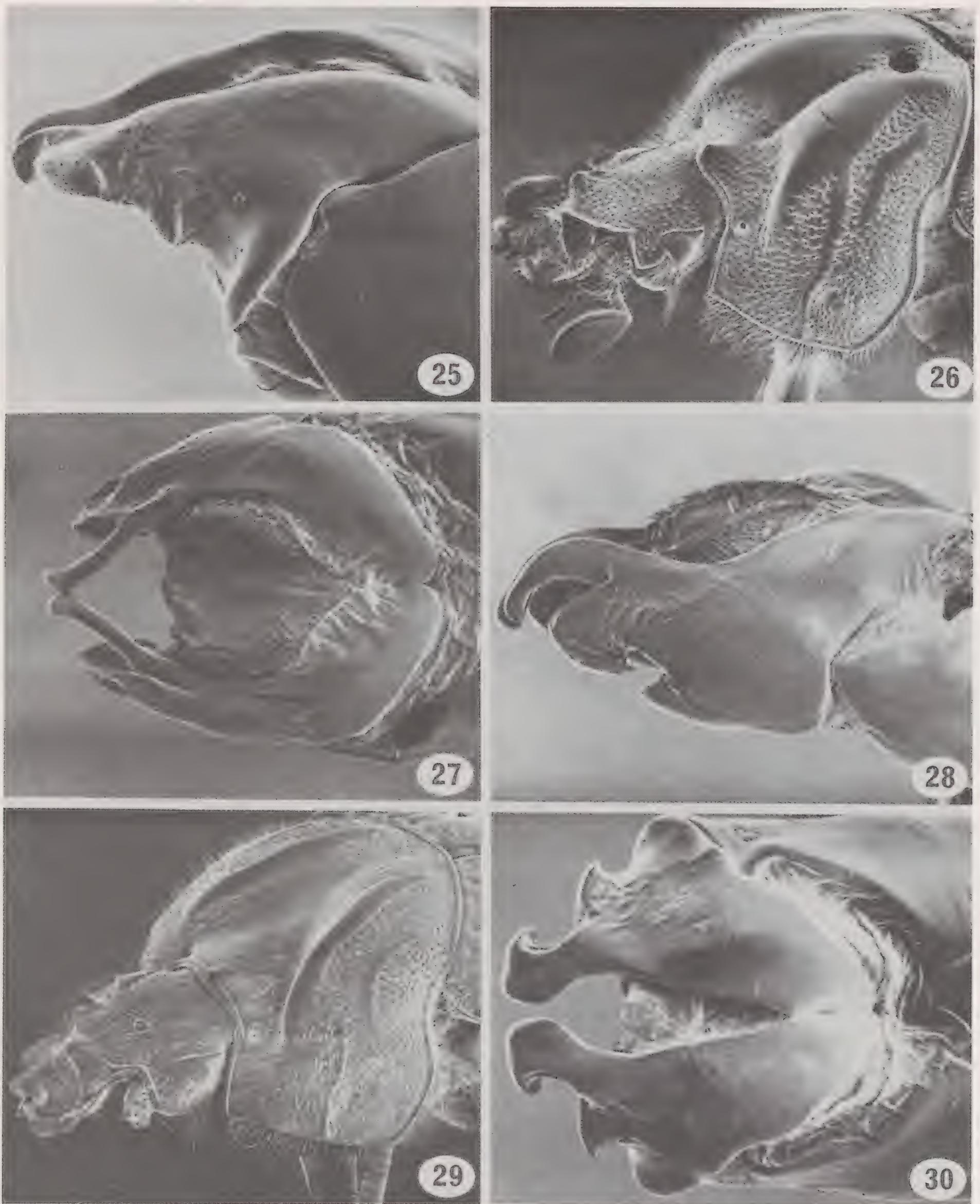


Fig. 25. Neoathyreus latidorsalis n. sp. 25. Male genitalia, lateral view. Figs. 26-28. Neoathyreus purpureipennis (Westwood). 26. Male, head and pronotum; 27. Male genitalia, dorsal view; 28. Male genitalia, lateral view. Figs. 29, 30. Neoathyreus anthracinus (Klug). 29. Male, head and pronotum; 30. Male genitalia, dorsal view.

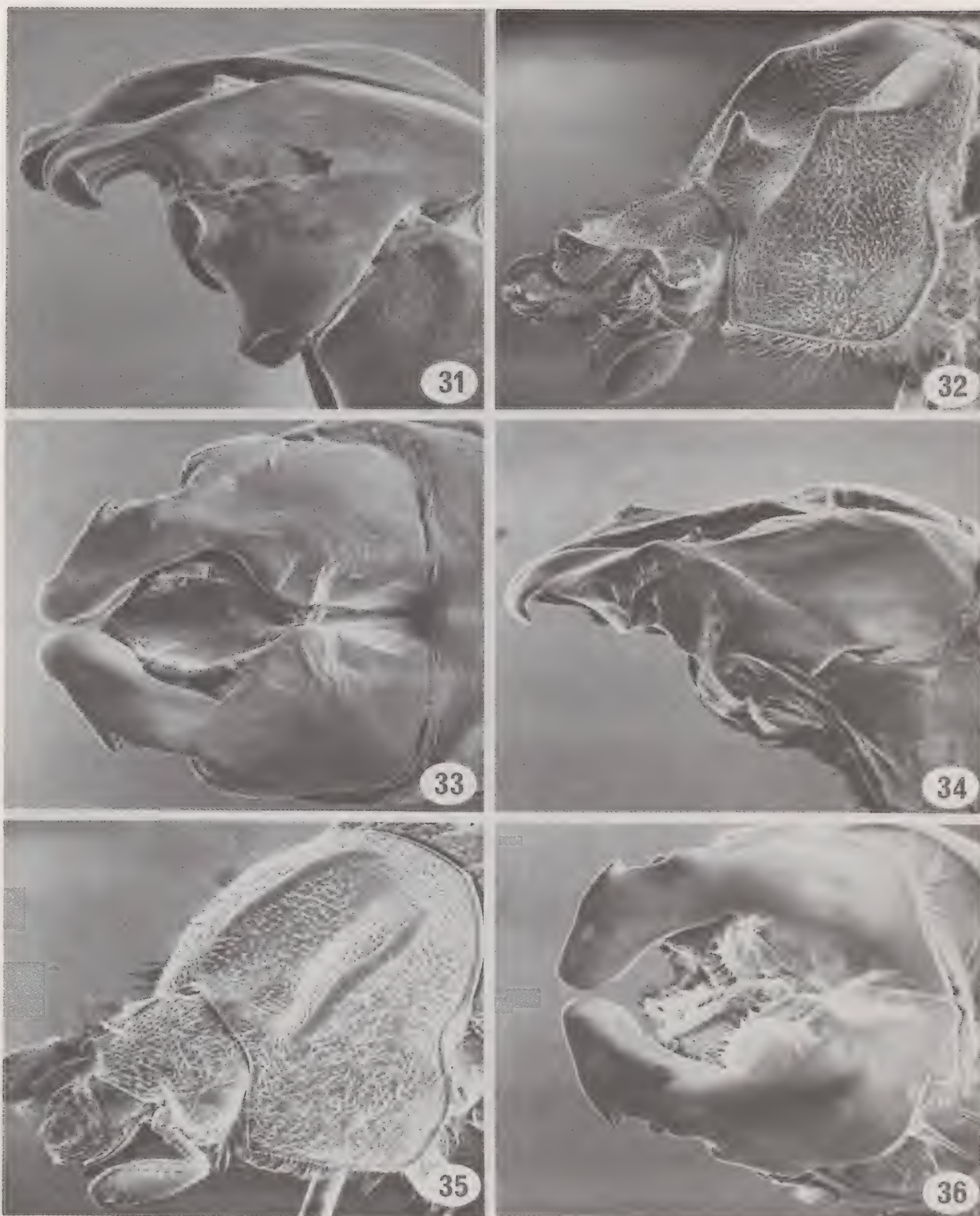


Fig. 31. *Neoathyreus anthracinus* (Klug). 31. Male genitalia, lateral view. Figs. 32-34. *Neoathyreus cuspinotatus* n. sp. 32. Male, head and pronotum; 33. Male genitalia, dorsal view; 34. Male genitalia, lateral view. Figs. 35, 36. *Neoathyreus bidentatus* (Macleay). 35. Male, head and pronotum; 36. Male genitalia, dorsal view.

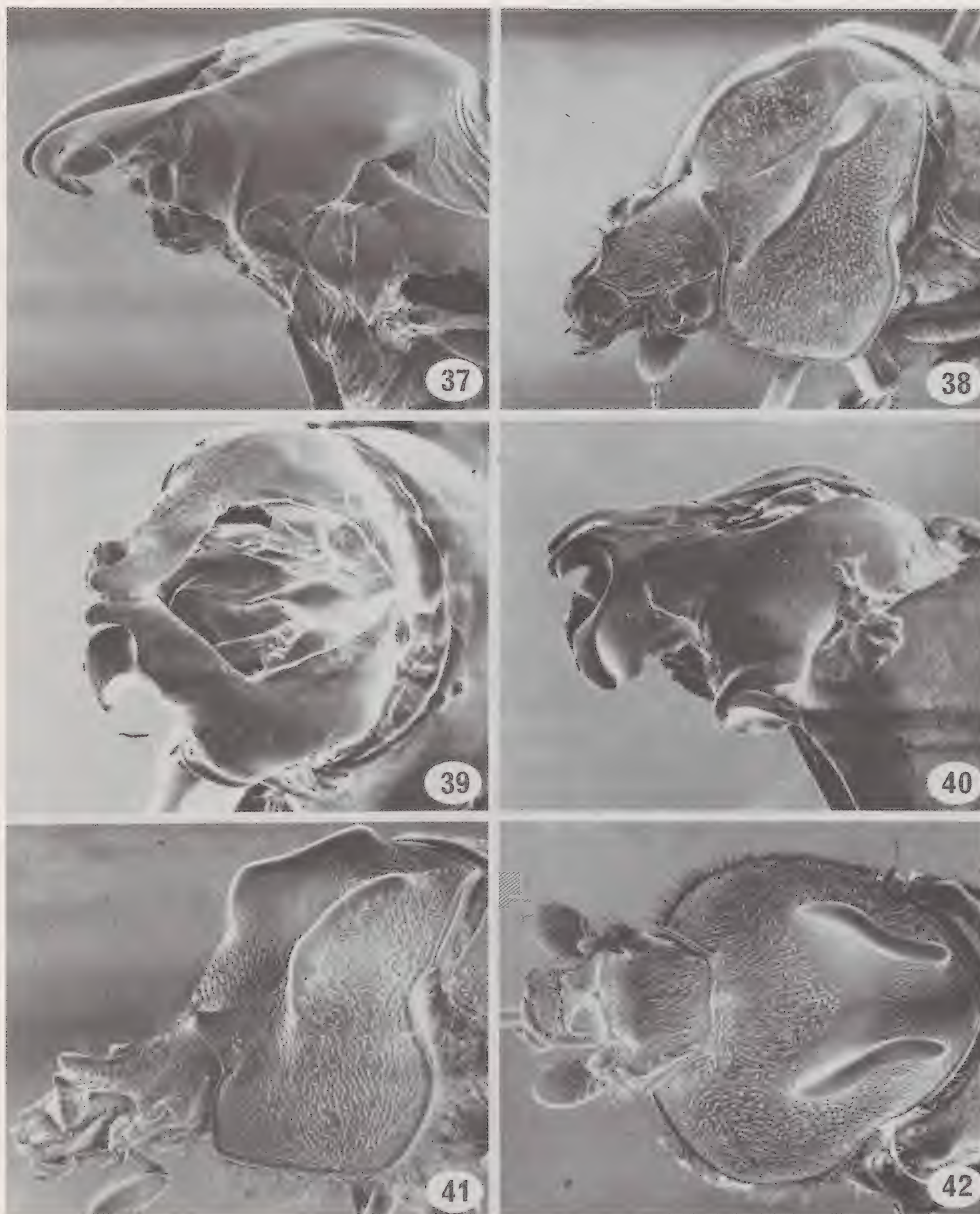
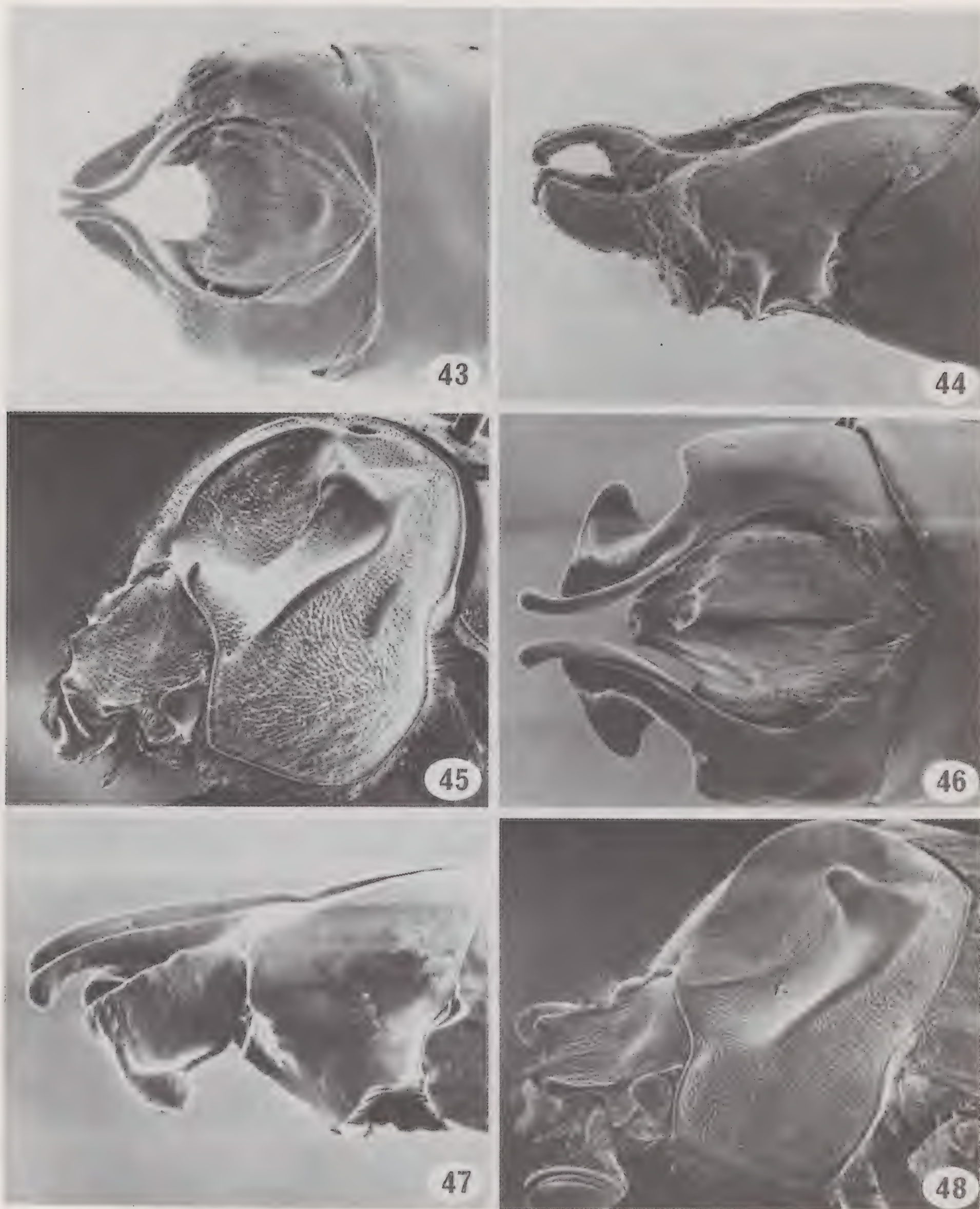
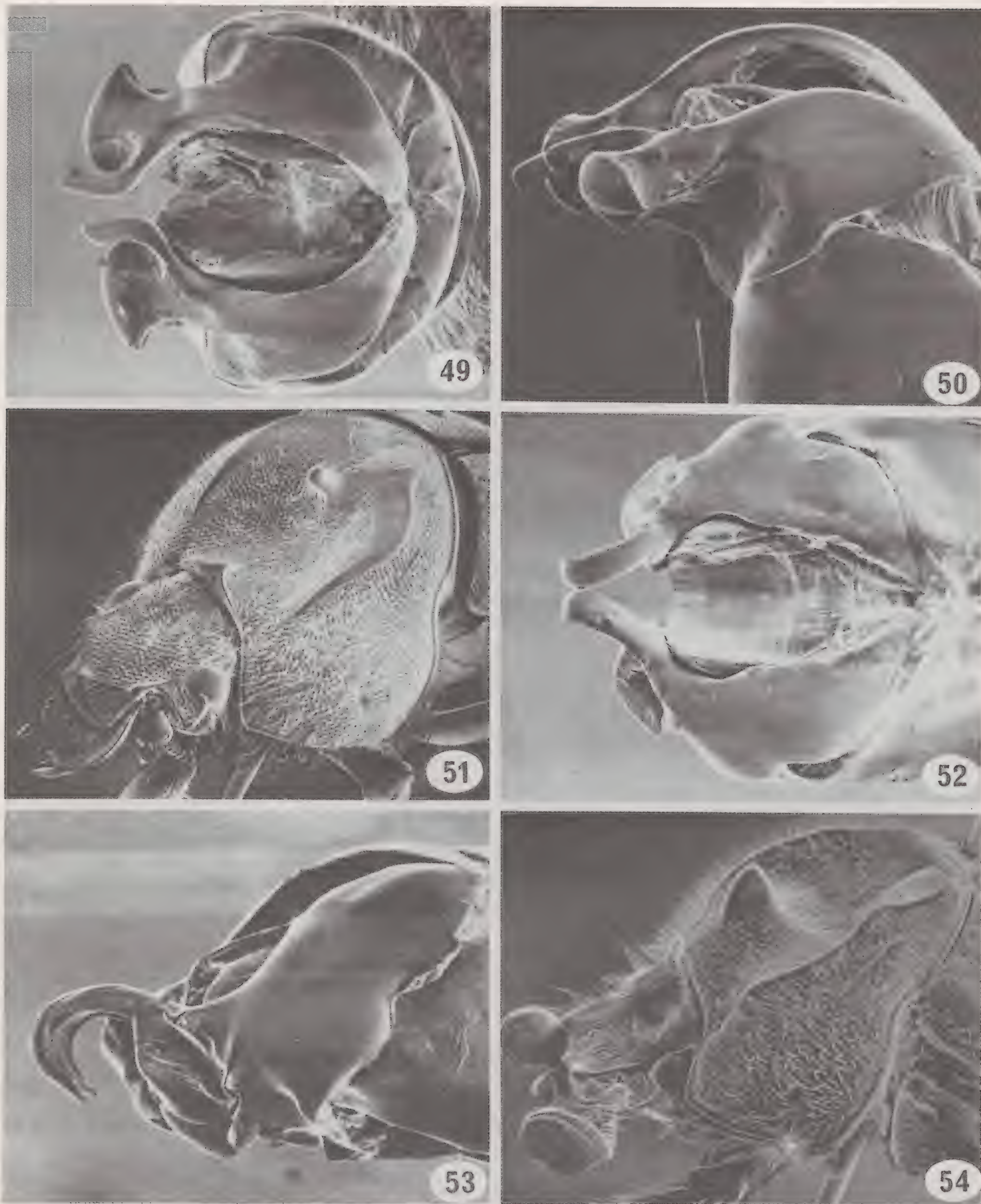


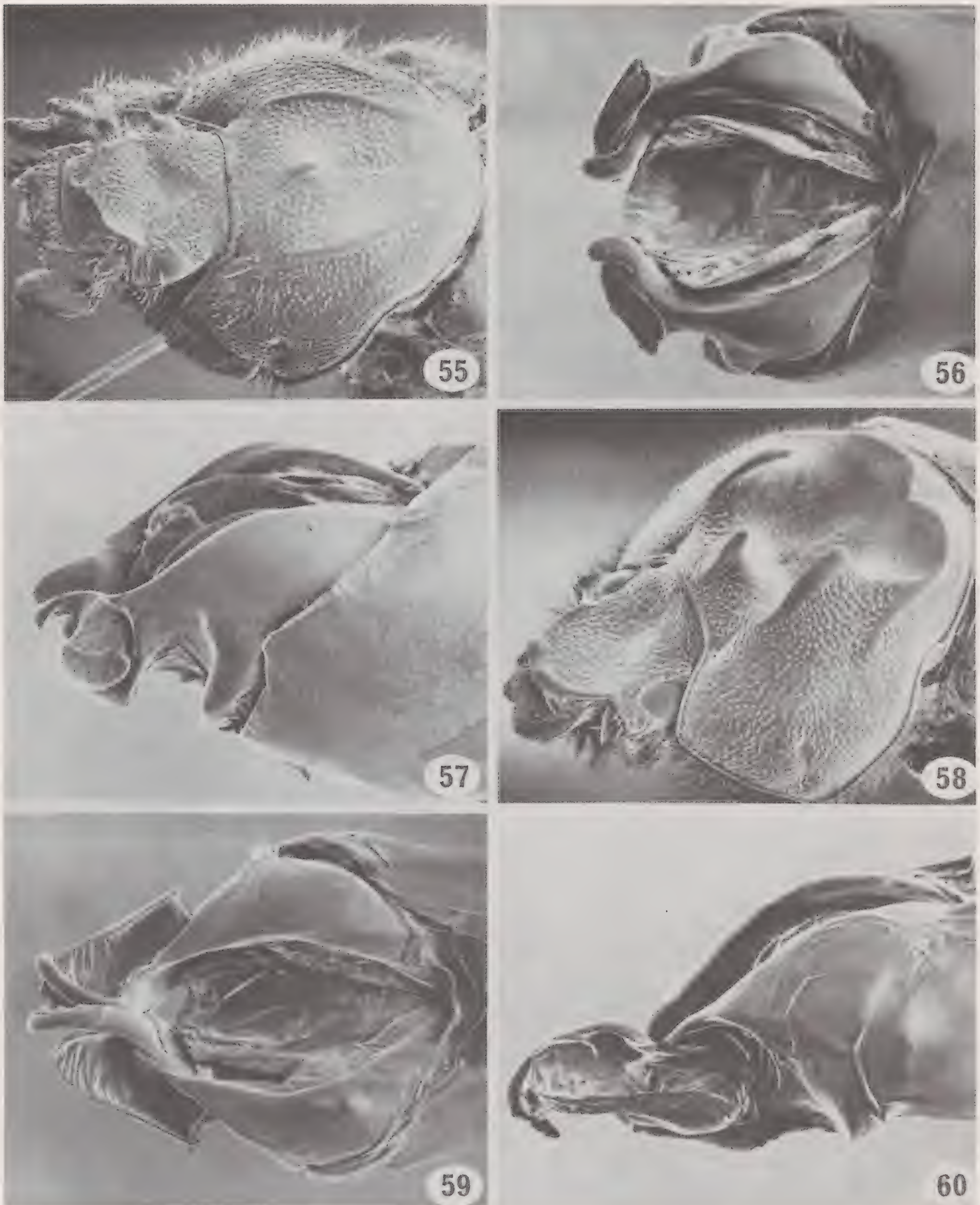
Fig. 37. *Neoathyreus bidentatus* (Macleay). 37. Male genitalia, lateral view. Figs. 38-40. *Neoathyreus sexdentatus* (Laporte). 38. Male, head and pronotum; 39. Male genitalia, dorsal view; 40. Male genitalia, lateral view. Figs. 41, 42. *Neoathyreus centromaculatus* (Felsche). 41, 42. Male, head and pronotum.



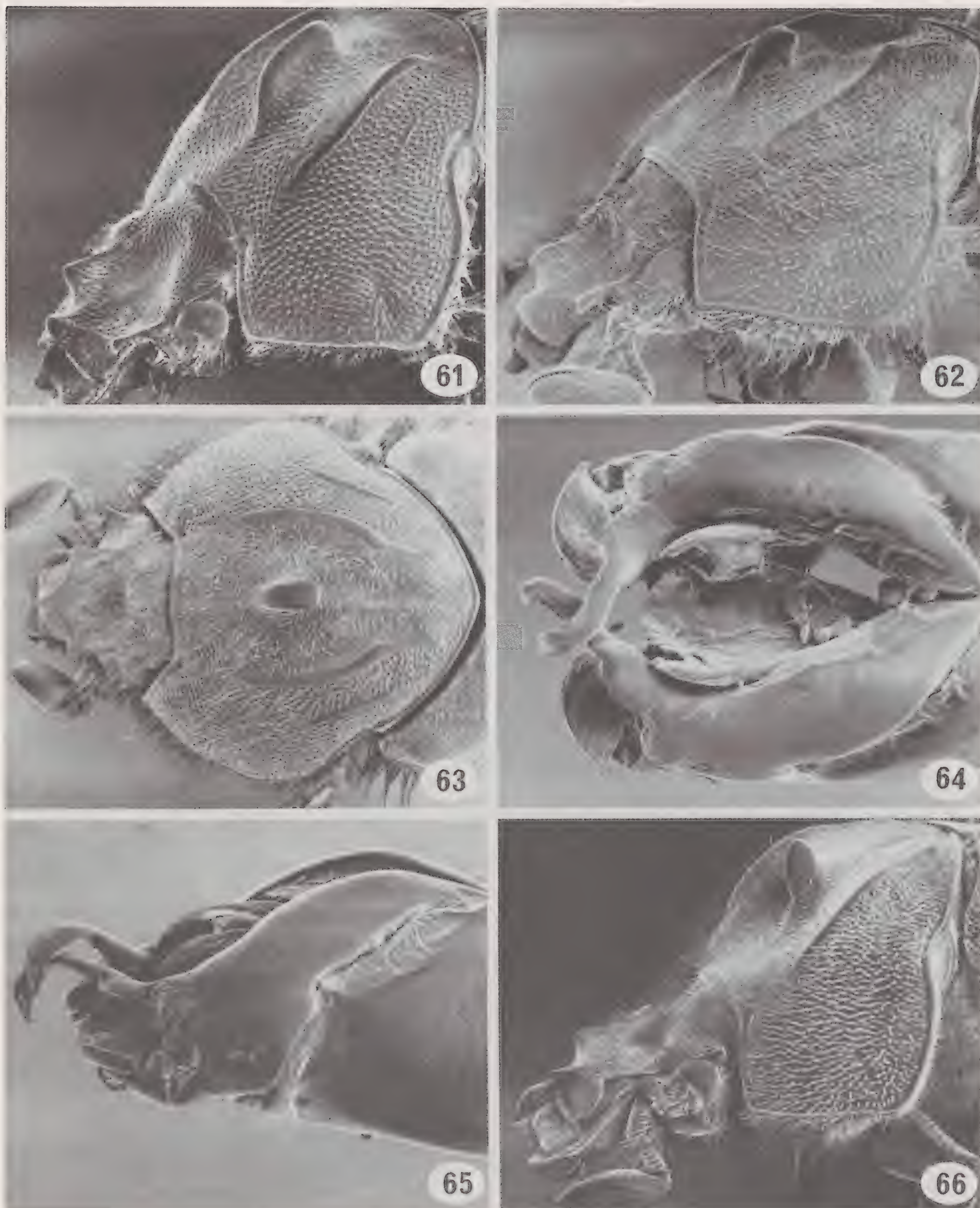
Figs. 43, 44. *Neoathyreus centromaculatus* (Felsche). 43. Male genitalia, dorsal view; 44. Male genitalia, lateral view. Figs. 45-47. *Neoathyreus peckorum* n. sp. 45. Male, head and pronotum; 46. Male genitalia, dorsal view; 47. Male genitalia, lateral view. Fig. 48. *Neoathyreus corniculatus* (Felsche). 48. Male, head and pronotum.



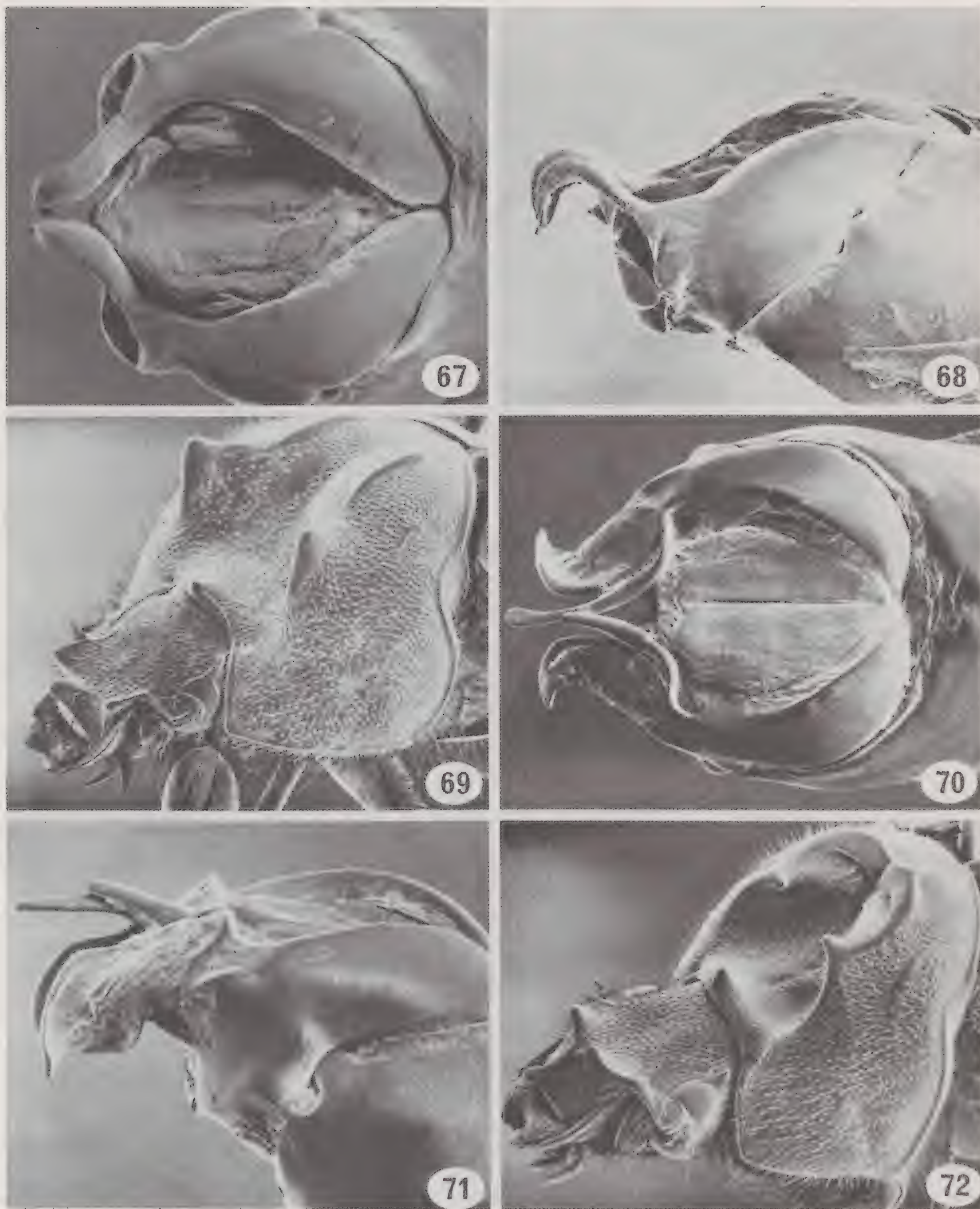
Figs. 49, 50. *Neoathyreus corniculatus* (Felsche). 49. Male genitalia, dorsal view; 50. Male genitalia, lateral view. Figs. 51-53. *Neoathyreus lobus* n. sp. 51. Male, head and pronotum; 52. Male genitalia, dorsal view; 53. Male genitalia, lateral view. Fig. 54. *Neoathyreus reichii* (Westwood). 54. Male, head and pronotum.



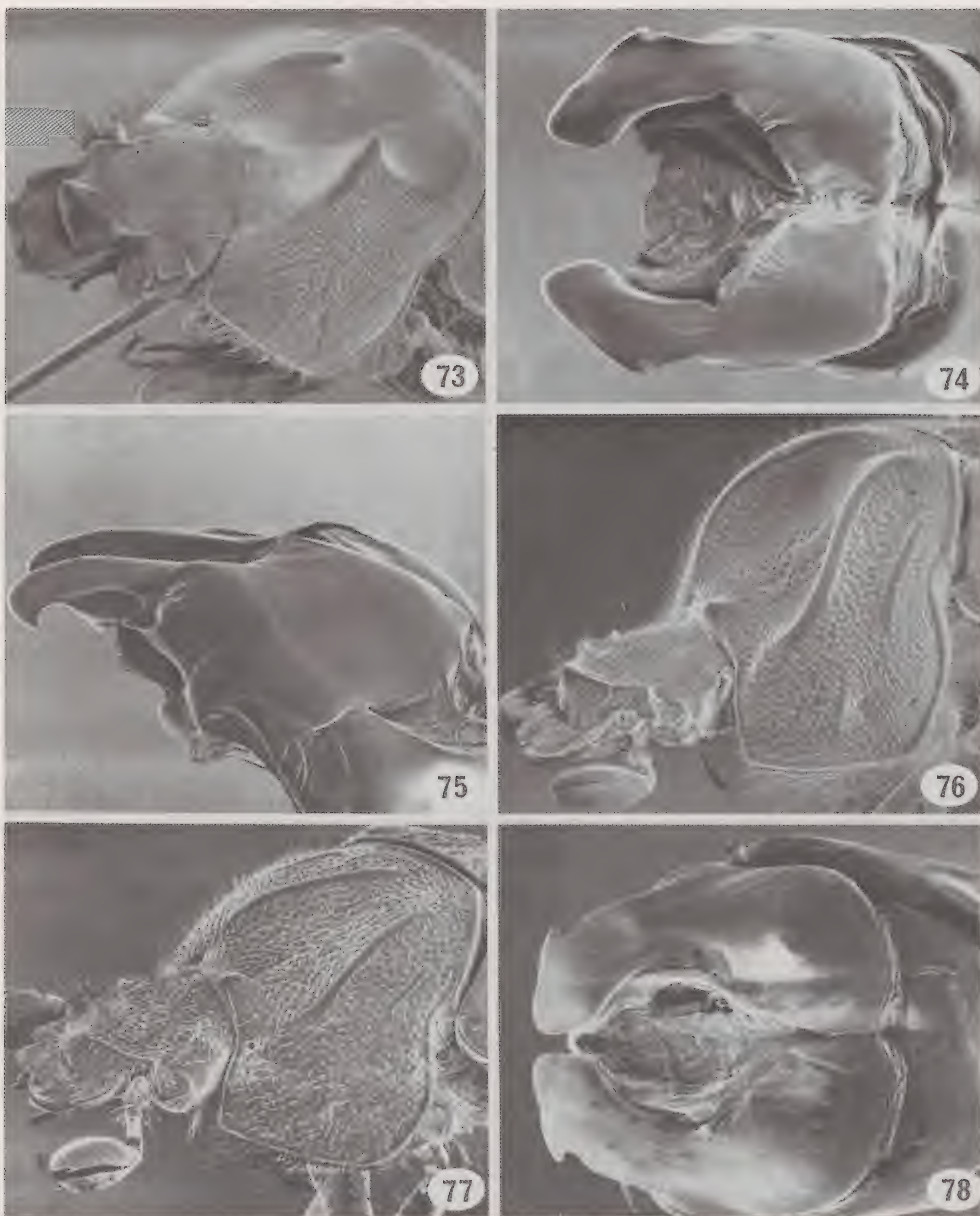
Figs. 55-57. *Neoathyreus reichii* (Westwood). 55. Female, head and pronotum; 56. Male genitalia, dorsal view; 57. Male genitalia, lateral view. Figs. 58-60. *Neoathyreus pholas* (Westwood). 58. Male, head and pronotum; 59. Male genitalia, dorsal view; 60. Male genitalia, lateral view.



Figs. 61-65. *Neoathyreus centralis* (Westwood). 61. Male, head and pronotum; 62, 63. Female, head and pronotum; 64. Male genitalia, dorsal view; 65. Male genitalia, lateral view. Fig. 66. *Neoathyreus lingi* n. sp. 66. Female, head and pronotum.



Figs. 67, 68. *Neoathyreus lingi* n. sp. 67. Male genitalia, dorsal view; 68. Male genitalia, lateral view. Figs. 69-71. *Neoathyreus goyasensis* (Boucomont). 69. Male, head and pronotum; 70. Male genitalia, dorsal view; 71. Male genitalia, lateral view. Fig. 72. *Neoathyreus boosi* n. sp. 72. Female, head and pronotum.



Figs. 73-75. *Neathyreus catharinae* (Bates). 73. Male, head and pronotum; 74. Male genitalia, dorsal view; 75. Male genitalia, lateral view. Figs. 76-78. *Neathyreus corinthius* (Klug). 76. Male, head and pronotum; 77. Female, head and pronotum; 78. Male genitalia, dorsal view.

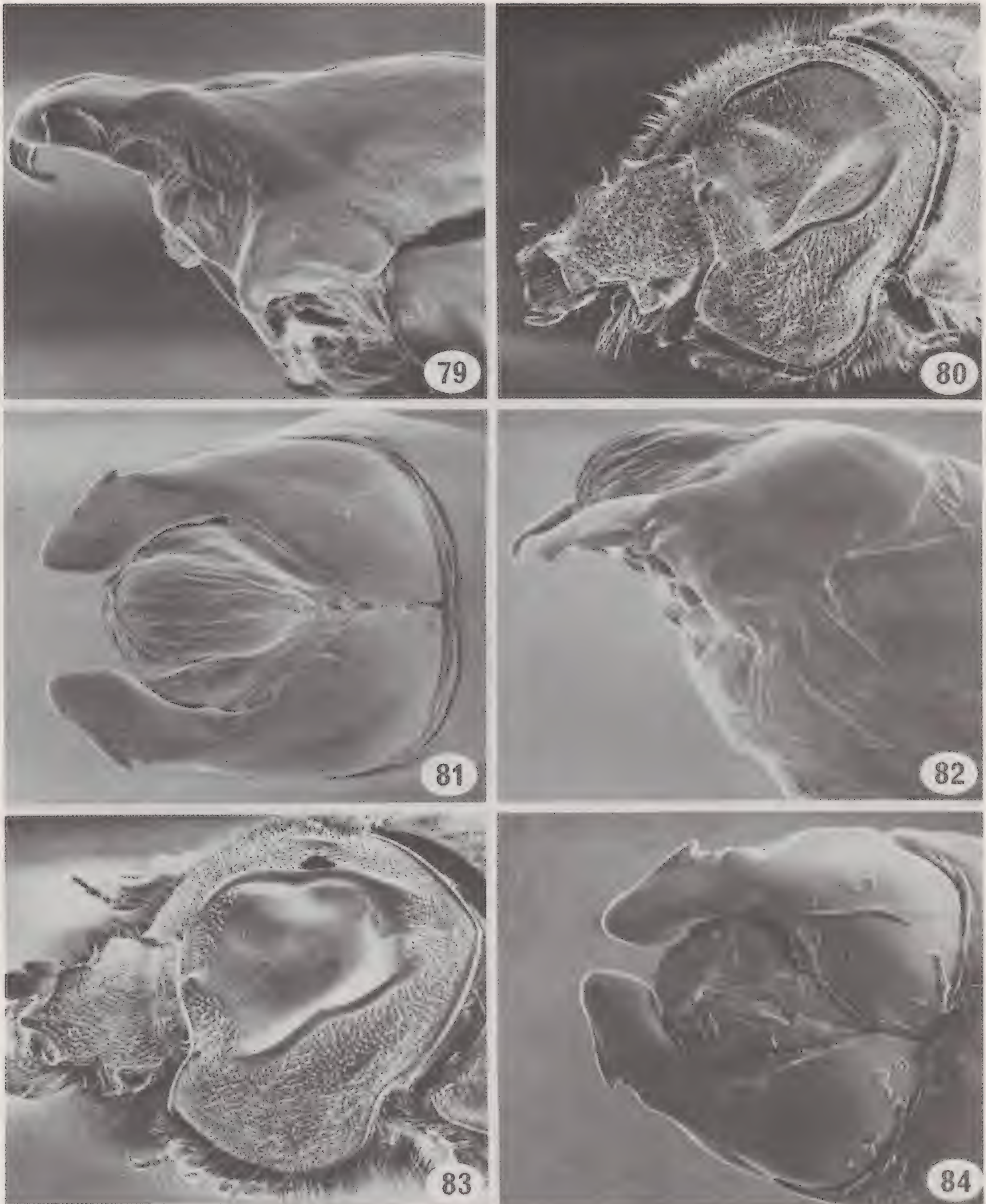


Fig. 79. *Neoathyreus corinthius* (Klug). 79. Male genitalia, lateral view. Figs. 80-82. *Neoathyreus tridentatus* (Macleay). 80. Male, head and pronotum; 81. Male genitalia, dorsal view; 82. Male genitalia, lateral view. Figs. 83, 84. *Neoathyreus politus* n. sp. 83. Male, head and pronotum; 84. Male genitalia, dorsal view.

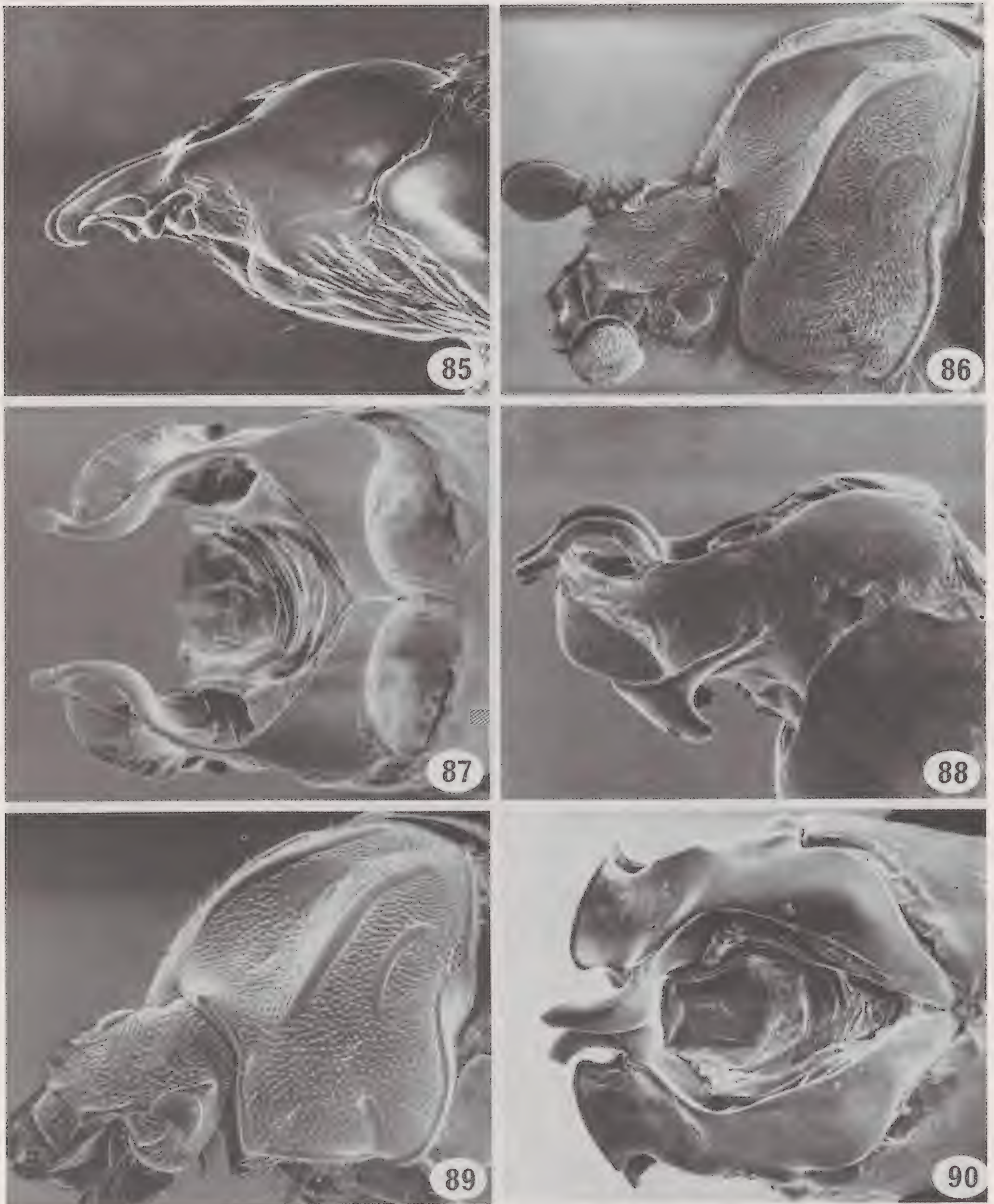


Fig. 85. *Neoathyreus politus* n. sp. 85. Male genitalia, lateral view. Figs. 86-88. *Neoathyreus excavatus* (Laporte). 86. Male, head and pronotum; 87. Male genitalia, dorsal view; 88. Male genitalia, lateral view. Figs. 89, 90. *Neoathyreus lanei* (Martínez). 89. Male, head and pronotum; 90. Male genitalia, dorsal view.

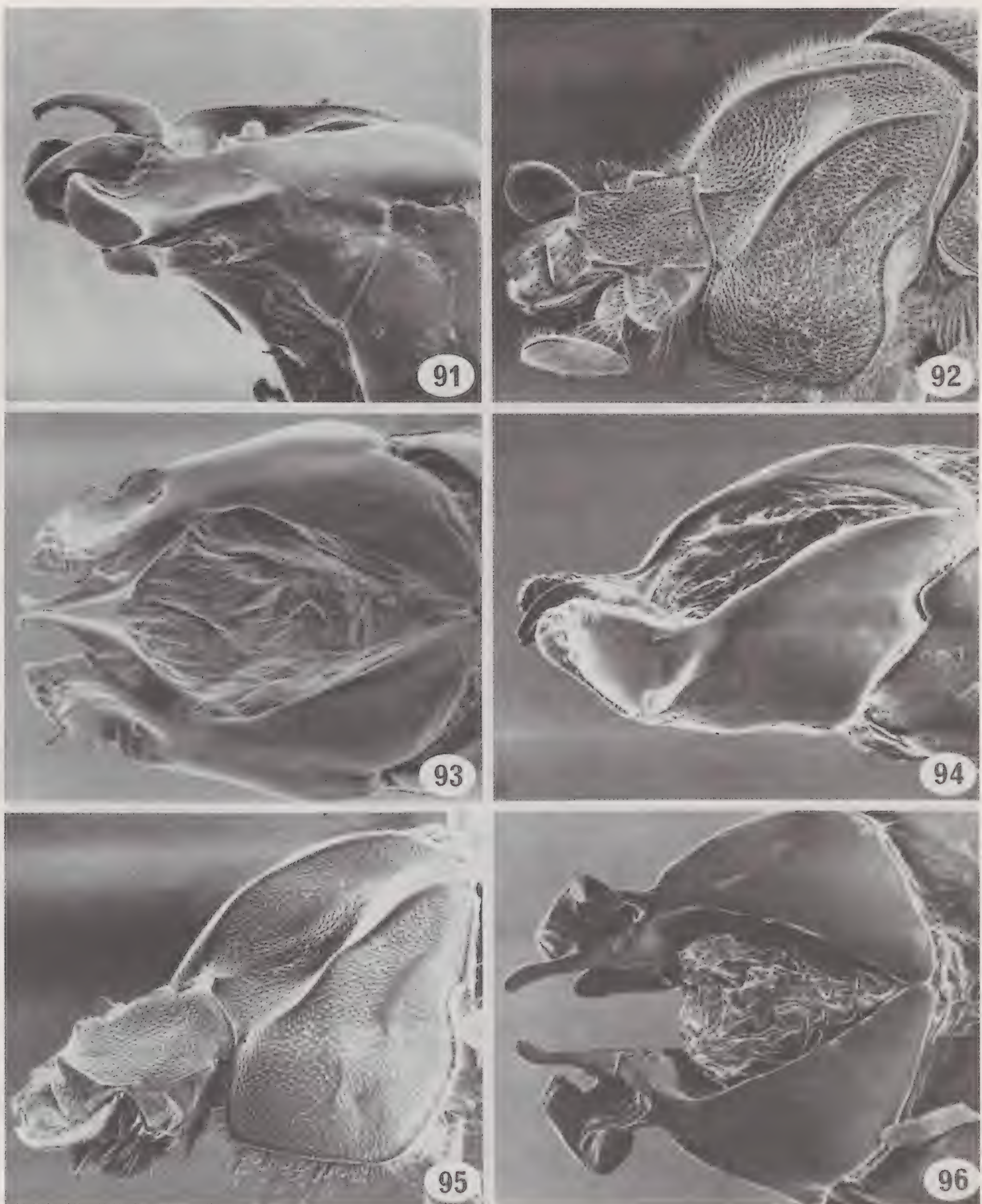


Fig. 91. *Neoathyreus lanei* (Martinez). 91. Male genitalia, lateral view. Figs. 92-94. *Neoathyreus obscurus* n. sp. 92. Male, head and pronotum; 93. Male genitalia, dorsal view; 94. Male genitalia, lateral view. Figs. 95, 96. *Neoathyreus ornatus* n. sp. 95. Male, head and pronotum; 96. Male genitalia, dorsal view.

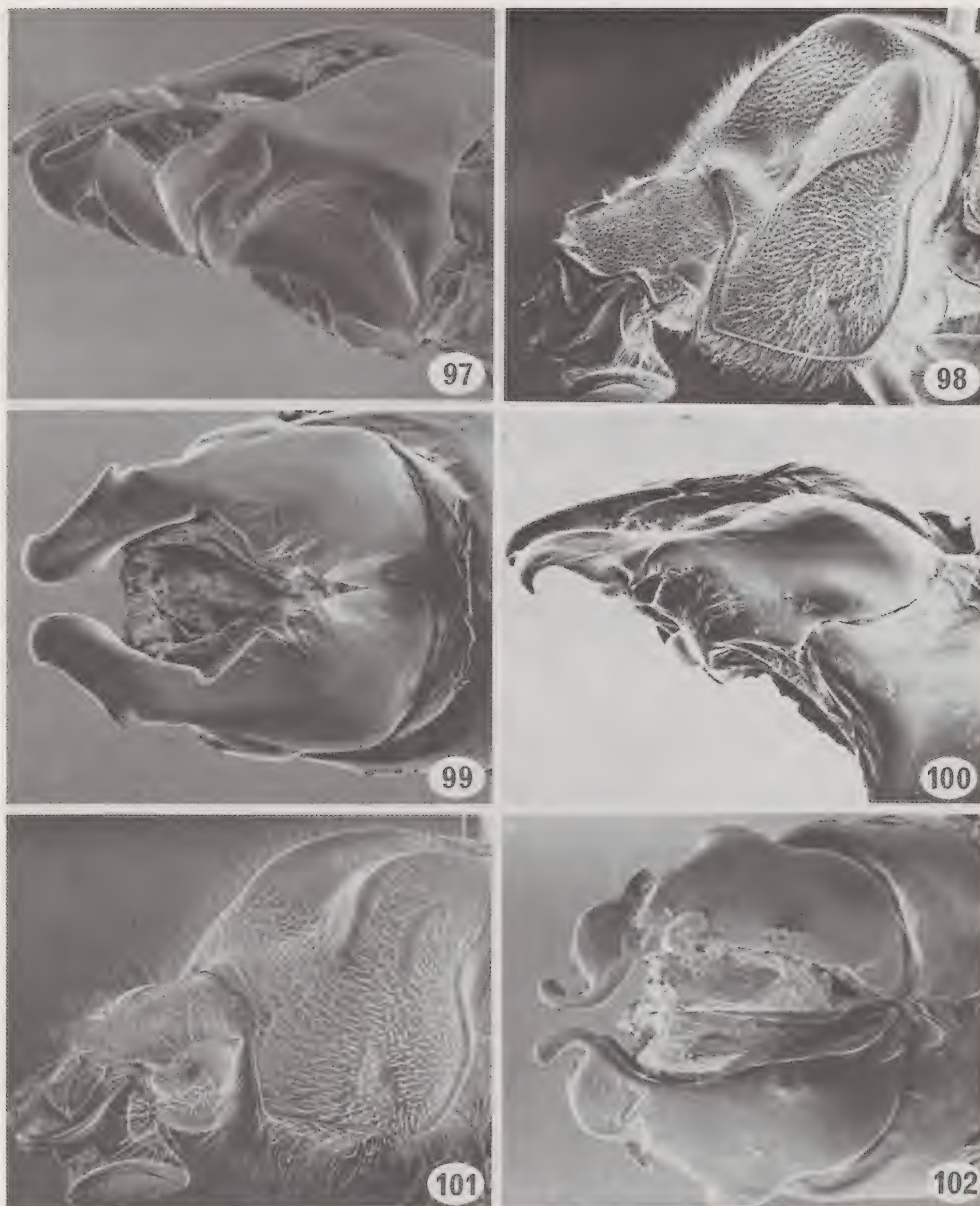


Fig. 97. Neoathyreus ornatus n. sp. 97. Male genitalia, lateral view. Figs. 98-100. Neoathyreus caesariatus n. sp. 98. Male, head and pronotum; 99. Male genitalia, dorsal view; 100. Male genitalia, lateral view. Figs. 101, 102. Neoathyreus illotus n. sp. 101. Male, head and pronotum; 102. Male genitalia, dorsal view.



Fig. 103. *Neoathyreus illotus* n. sp. 103. Male genitalia, lateral view. Figs. 104-106. *Neoathyreus versicolor* n. sp. 104. Male, head and pronotum; 105. Male genitalia, dorsal view; 106. Male genitalia, lateral view. Figs. 107, 108. *Neoathyreus martinezorum* n. sp. 107. Male, head and pronotum; 108. Male genitalia, dorsal view.

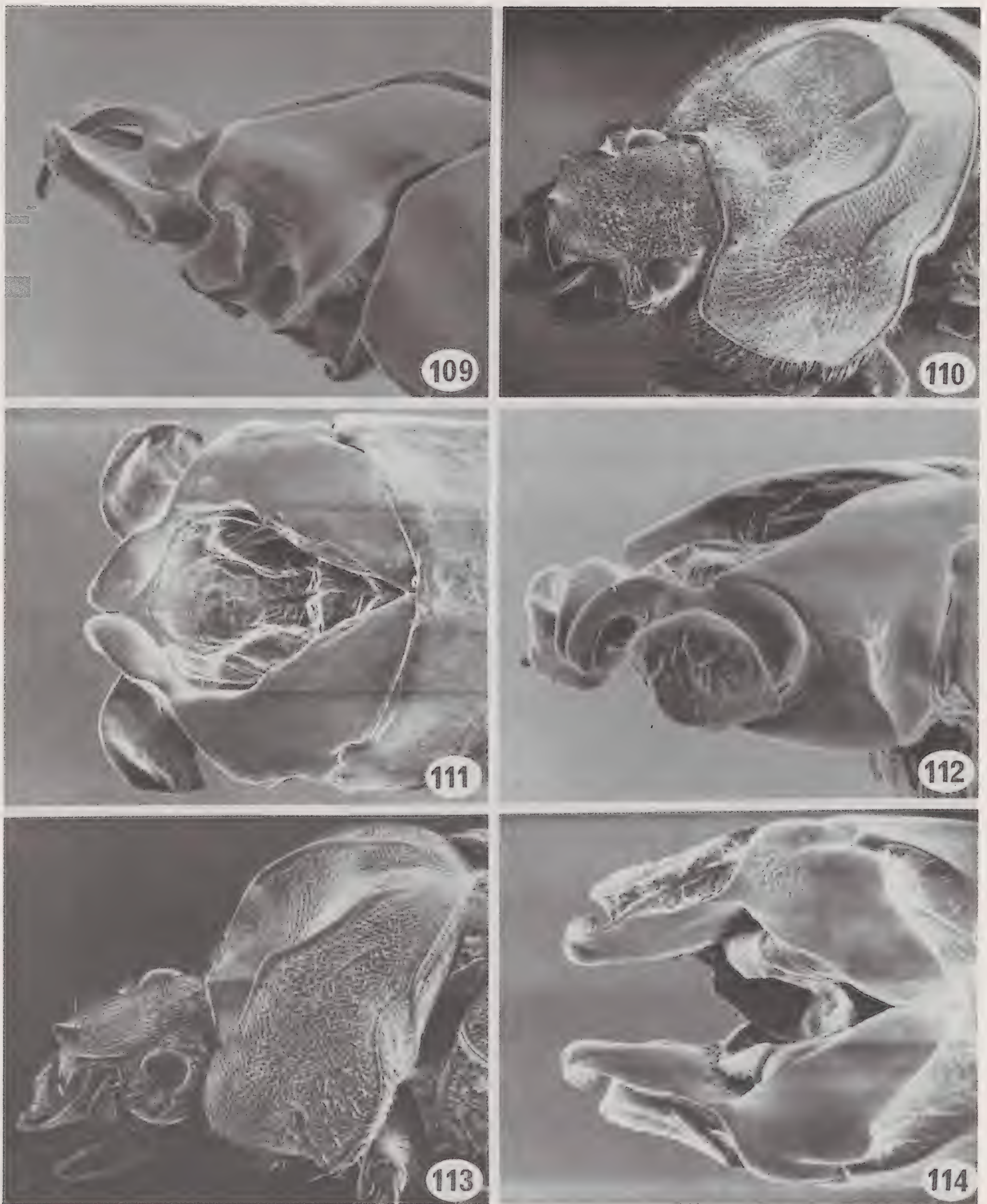


Fig. 109. Neoathyreus martinezorum n. sp. 109. Male genitalia, lateral view. Figs. 110-112. Neoathyreus latecavatus (Boucomont). 110. Male, head and pronotum; 111. Male genitalia, dorsal view; 112. Male genitalia, lateral view. Figs. 113, 114. Neoathyreus rufobrunneus n. sp. 113. Male, head and pronotum; 114. Male genitalia, dorsal view.

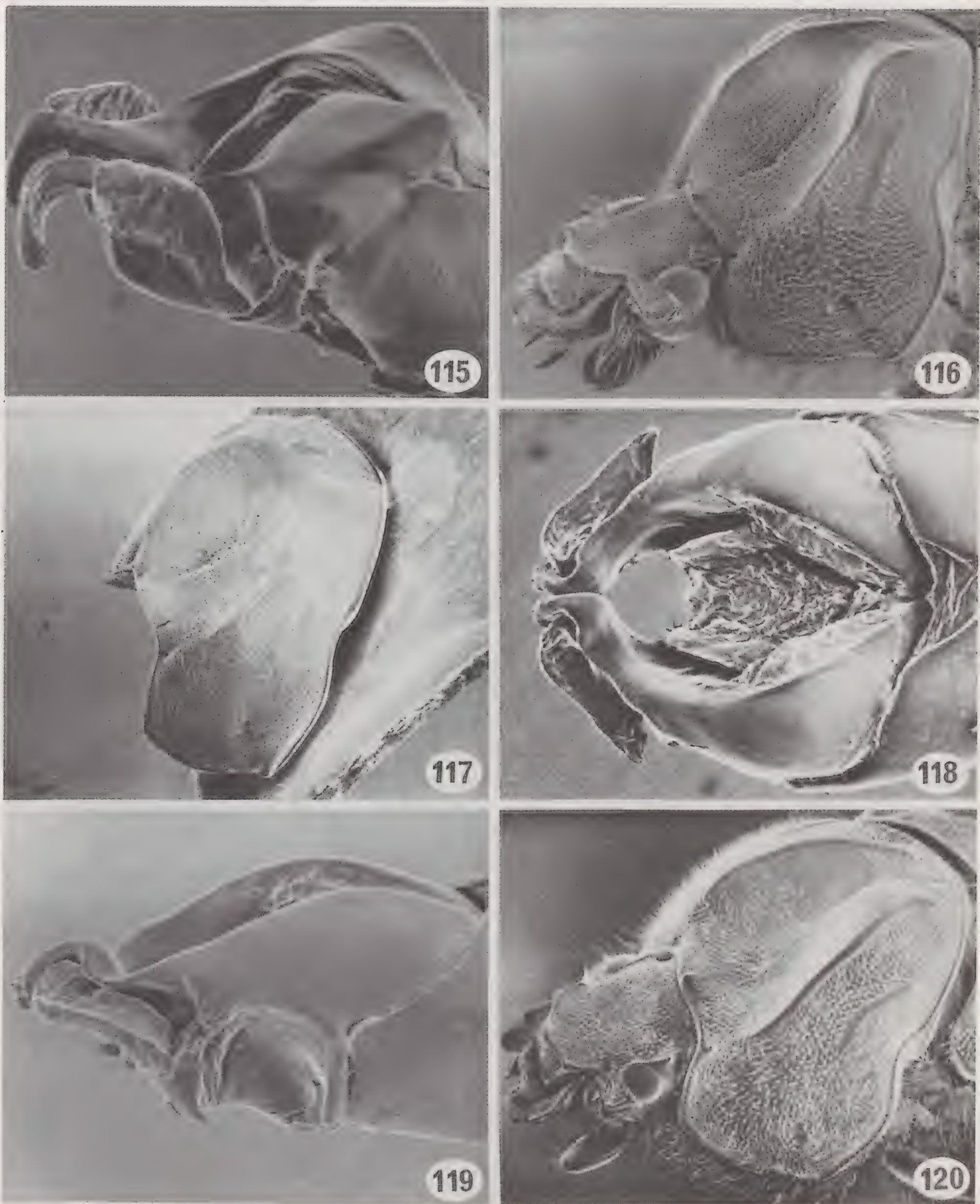
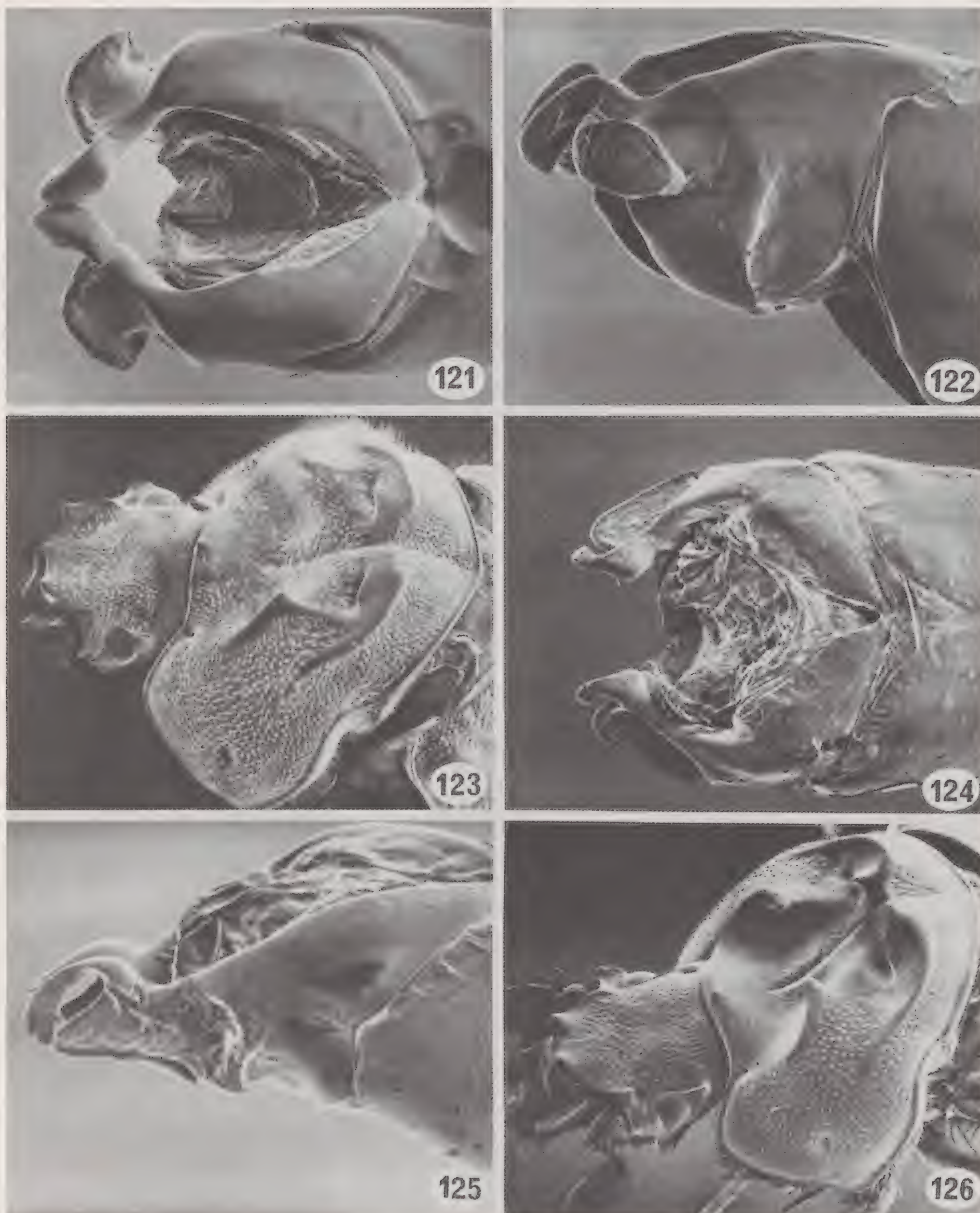
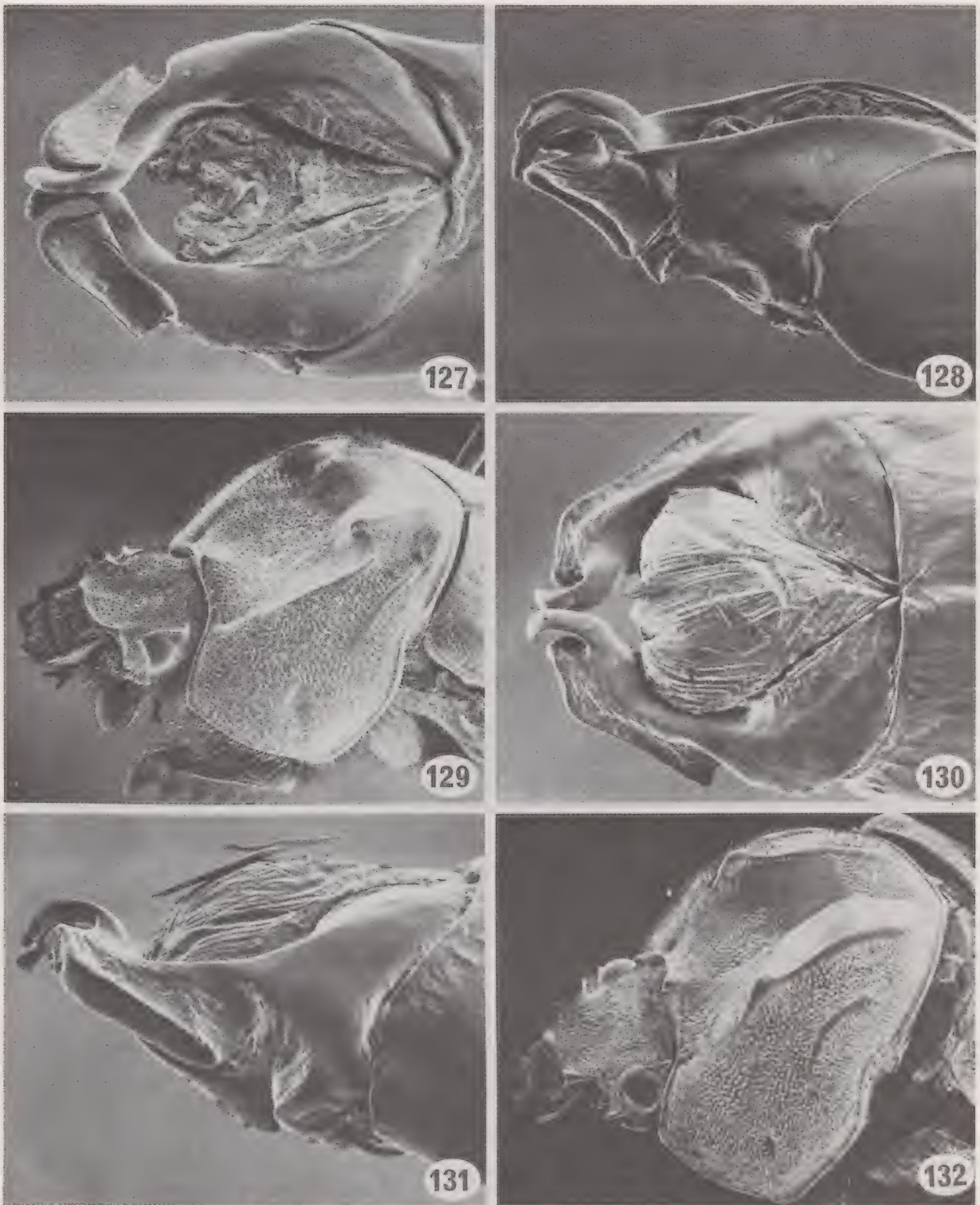


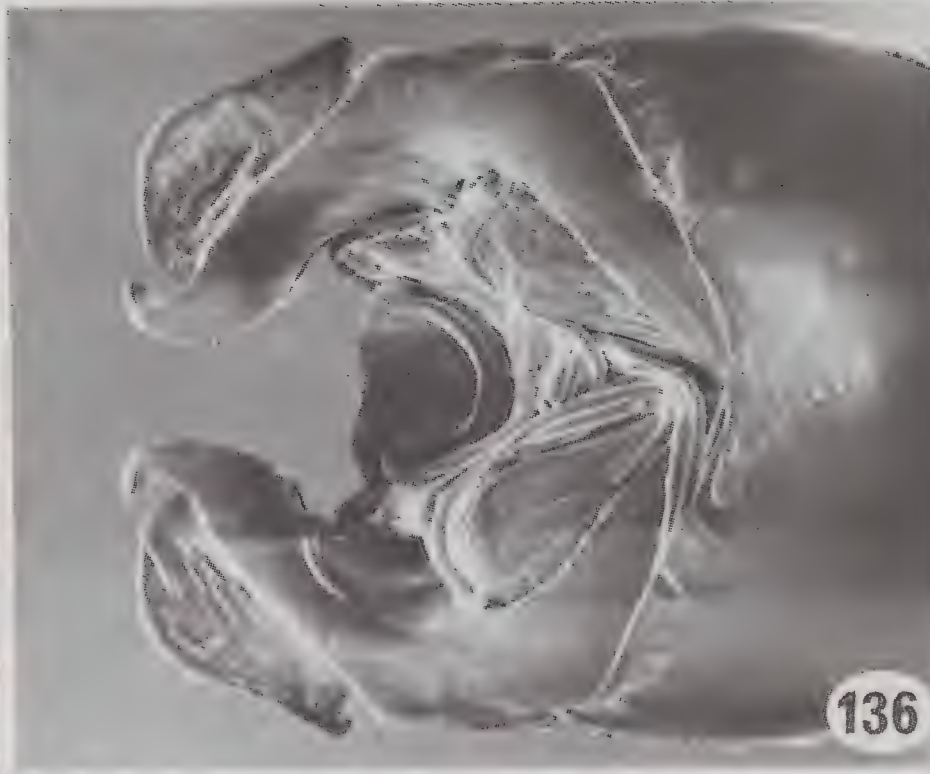
Fig. 115. *Neoathyreus rufobrunneus* n. sp. 115. Male genitalia, lateral view. Figs. 116-119. *Neoathyreus perryae* n. sp. 116. Male, head and pronotum; 117. Fossil, pronotum; 118. Male genitalia, dorsal view; 119. Male genitalia, lateral view. Fig. 120. *Neoathyreus lanuginosus* (Klug). 120. Male, head and pronotum.



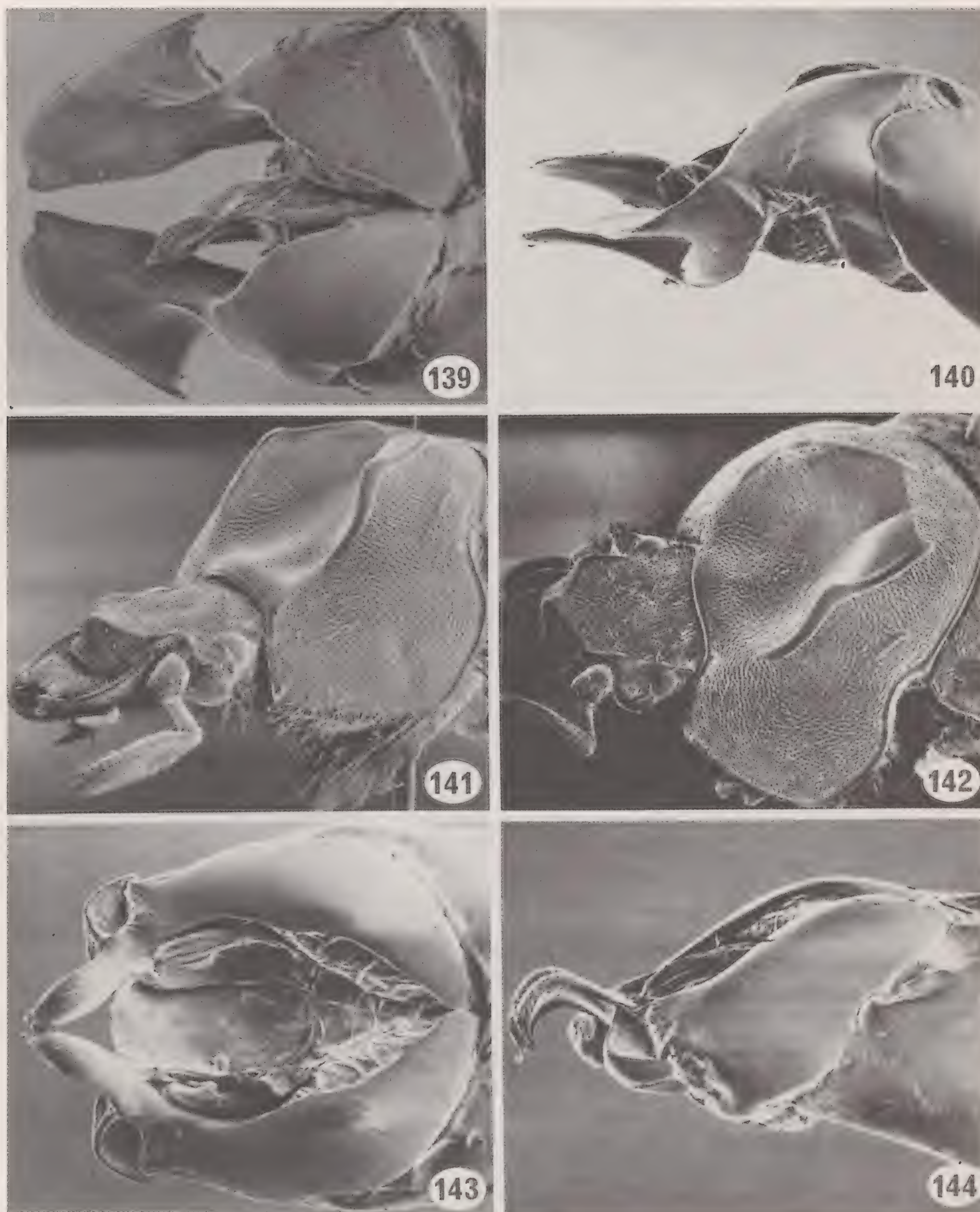
Figs. 121, 122. *Neoathyreus lanuginosus* (Klug). 121. Male genitalia, dorsal view; 122. Male genitalia, lateral view. Figs. 123-125. *Neoathyreus lyriferus* Howden & Gill. 123. Male, head and pronotum; 124. Male genitalia, dorsal view; 125. Male genitalia, lateral view. Fig. 126. *Neoathyreus accinctus* n. sp. 126. Male, head and pronotum.



Figs. 127, 128. *Neoathyreus accinctus* n. sp. 127. Male genitalia, dorsal view; 128. Male genitalia, lateral view. Figs. 129-131. *Neoathyreus lepidus* n. sp. 129. Male, head and pronotum; 130. Male genitalia, dorsal view; 131. Male genitalia, lateral view. Fig. 132. *Neoathyreus acutus* n. sp. 132. Male, head and pronotum.



Figs. 133, 134. *Neoathyreus acutus* n. sp. 133. Male genitalia, dorsal view; 134. Male genitalia, lateral view. Figs. 135-137. *Neoathyreus brazilensis* n. sp. 135. Male, head and pronotum; 136. Male genitalia, dorsal view; 137. Male genitalia, lateral view. Fig. 138. *Neoathyreus inermis* n. sp. 138. Male, head and pronotum.



Figs. 139, 140. *Neoathyreus inermis* n. sp. 139. Male genitalia, dorsal view; 140. Male genitalia, lateral view. Figs. 141-144. *Neoathyreus rufoventris* n. sp. 141, 142. Male, head and pronotum; 143. Male genitalia, dorsal view; 144. Male genitalia, lateral view.



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